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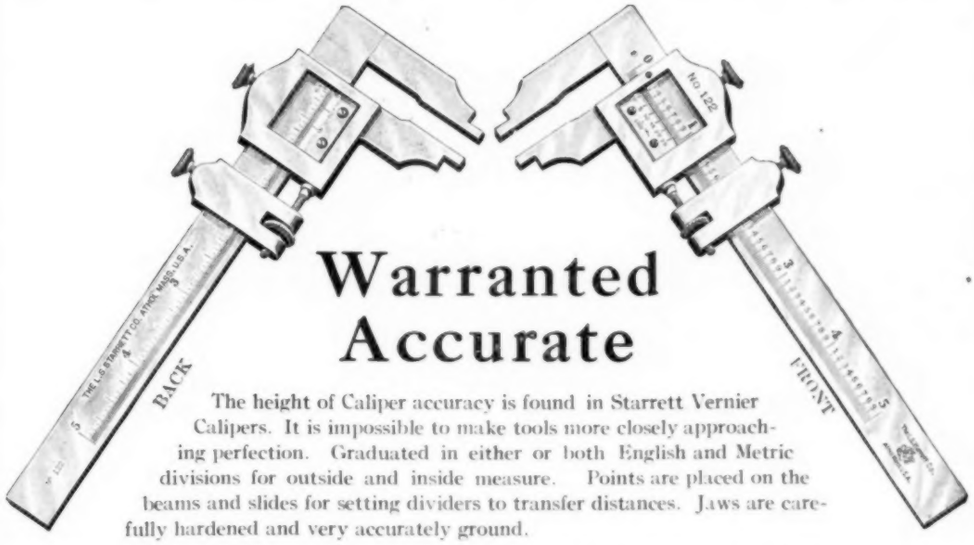
Starrett Vernier Calipers



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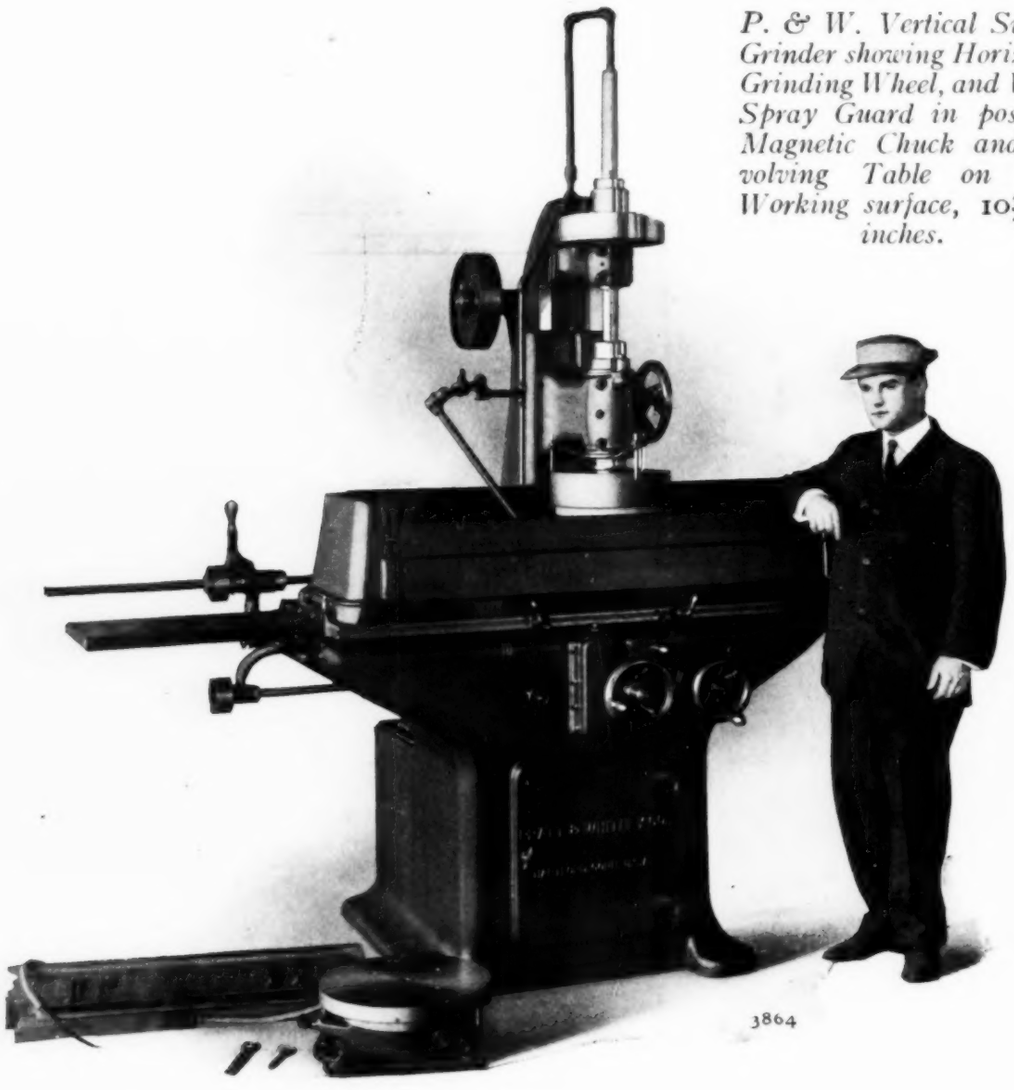

P. & W. Vertical Surface Grinder showing Horizontal Grinding Wheel, and Water Spray Guard in position. Magnetic Chuck and Revolving Table on floor. Working surface, 10¾x36 inches.

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Making the Waverley Automobile

By William W. Hudson

While the manufacture of an electric automobile does not require the fixtures and special tools for gasolene engine parts, there are many devices for machining axles, steering parts and differentials that should interest all those engaged in making automobiles.

The front axle of the Waverley electric automobile is of the Elliott type; a solid-steel drop forging of I-beam section forged complete in one piece.

After forging, the axle is milled and drilled. For this it is placed in a special fixture used on the No. 3 Cincinnati milling machine and shown in Fig. 1. The axle is secured to this fixture by two quick-acting clamps. When the faces of one end of the axle have been milled, the milling arbor is removed and a drill placed in the spindle instead. A little jig is attached to the fixture and guides the drill. When this end of the axle is machined, the fixture itself is loosened and moved past the center of the machine by sliding on a pair of rails secured to the milling-machine table, and the operations of milling and drilling the other end of the axle are performed. Thus the axle is machined at both ends before it is removed or loosened from the fixture, guaranteeing the parallelism of the two pivot bolts in opposite ends of the axle.

The wheel pivots of this front axle are made of the same open-hearth steel as the axle and each is made in a single forging. The left one is especially noteworthy on account of the two arms with the pivot, all being forged in one piece. For drilling and reaming they are secured in an adjustable jig, shown at the right of Fig. 2, having bell bushings at both top and bottom. The pivots are next faced by setting them upon one of two studs or posts in a plate, shown at the left of Fig. 2. The top of each post is hardened. A high-speed end mill, or

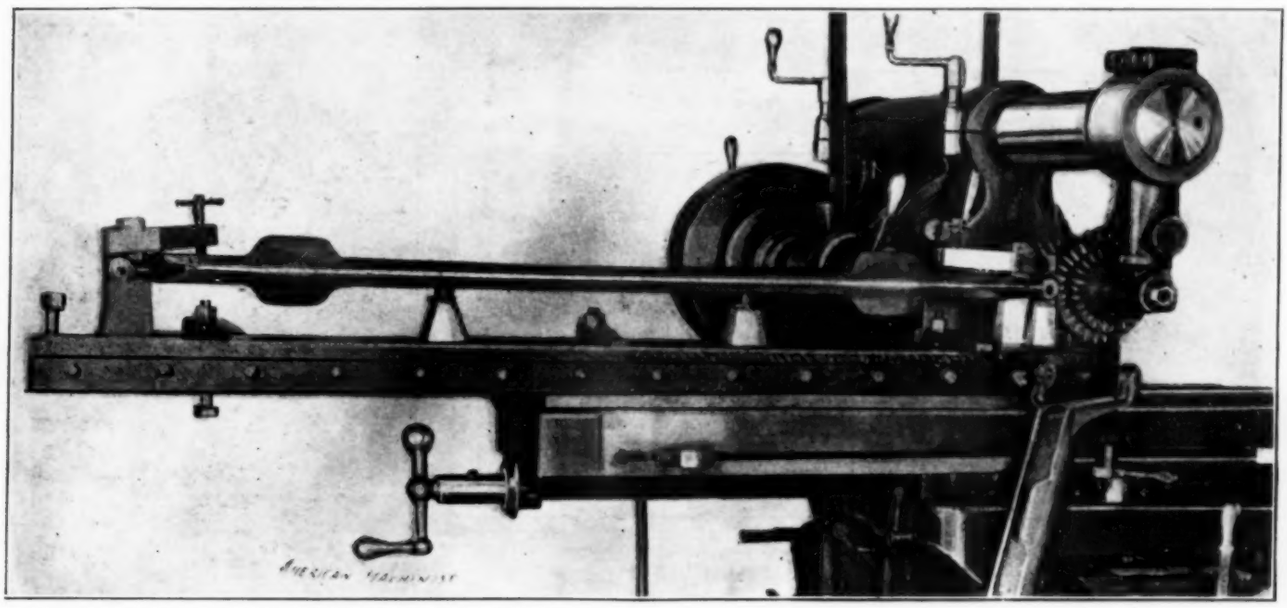


FIG. 1. MILLING AND DRILLING THE FRONT AXLE

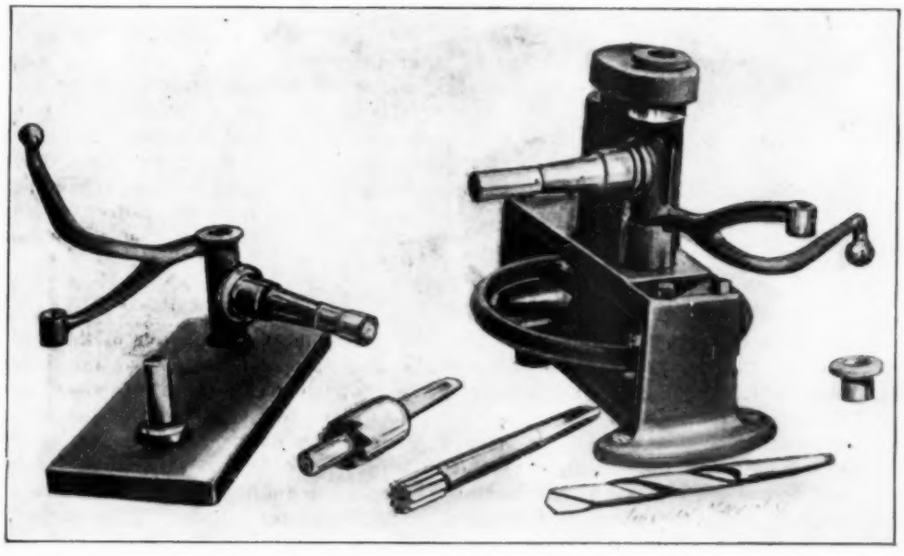


FIG. 2. DRILLING AND FACING THE PIVOT SLEEVE

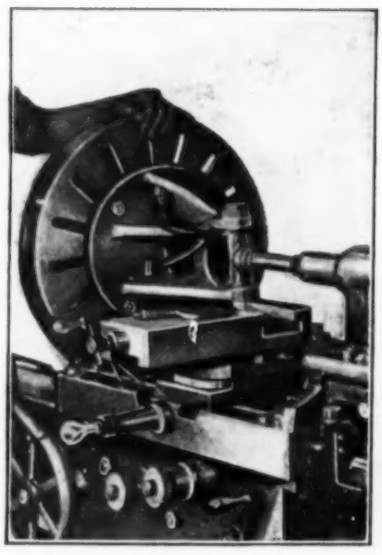


FIG. 3. TURNING THE PIVOT SPINDLE

facing cutter, is employed on a drill press, and has a hardened pilot, the end of which is at a constant distance from the cutting edge of the mill. One of the posts is a little higher than the other, and the pivot to be faced is first placed on the longer post. The facing tool cuts until its pilot is in contact with the top of the post. The pivot is then removed and set upon the other post with the finished end down. The facing tool is again used, until its pilot comes in contact with the end of this post, at which time the pivot has been properly faced and is ready for further operations. The brake spiders for the driving system are faced by the same method with similar tools.

Turning the Pivot

After being faced, the pivots are secured in a fixture on a lathe, for turning the spindle or axle portion. The fixture bears the same relation to the pivot as does the main axle, the pivot being secured in the fixture by a bolt through the hole previously machined. This fixture has in it the angularity desired, by means of which the wheels are toed in, when attached to the axle. This operation is shown in Fig. 3.

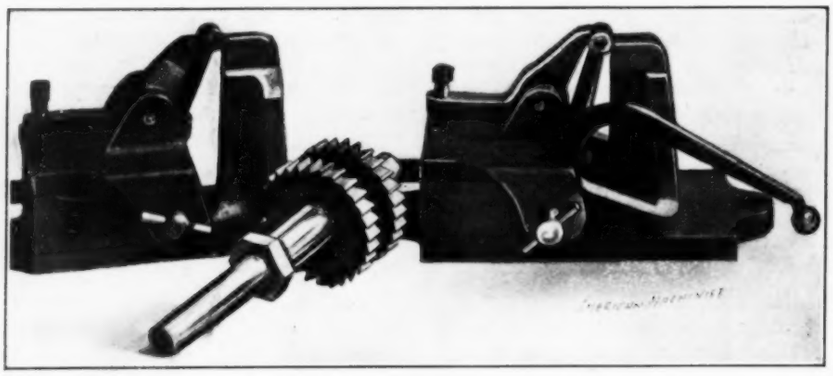


Fig. 4. Straddle Milling Pivot Arms

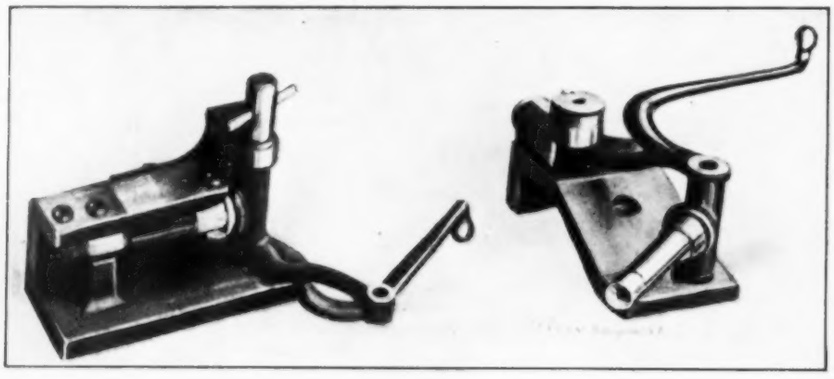


Fig. 5. Drilling Arms of Pivot

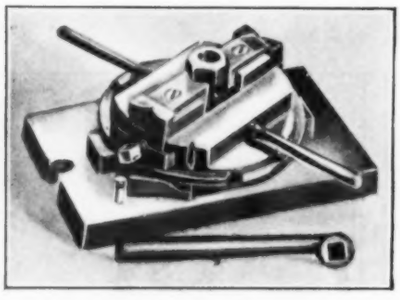


Fig. 7. Slotting Castle Nuts

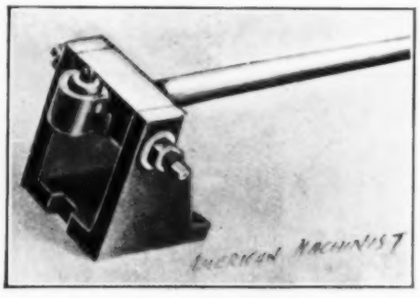


Fig. 8. Slotting Screws

The ends of the levers on the pivots, to which the cross rod is attached, are straddle milled in a fixture for that purpose, shown in Fig. 4. By unscrewing the set screw a few turns, all pressure is relieved from the pivot, and a mandrel extending horizontally through the top and bottom parts of the fixture and also through the pivot, is removed by hand, so that the pivot and cover are released together.

Drilling for the Pins

Fig. 5 shows two clever fixtures for drilling the lever ends of the pivot and drilling for pin key to hold the cone and for cotter pin at end.

A clever device, shown in Fig. 6, is employed instead of the compound rest on an engine lathe to turn the ball of the steering pivot. By operating the handwheel of this little fixture, the tool is guided circularly around the ball. Adjustment is given by a hand screw.

A fixture, consisting of a swiveled head automatically indexed at a certain number of points upon a stationary base, is employed upon a hand-milling machine for slotting castle nuts. All nuts are secured in a pair of V-jaws operated universally by a screw. This is shown in Fig. 7.

Screws are slotted by another fixture (Fig. 8), also mounted upon a milling machine, which employs no screws in clamping the work in place. By side motion of the long lever a moving jaw is separated from a stationary jaw and the work is inserted, whereupon the lever is returned to its center position. Upon bearing down on this lever or handle, the work is elevated to the cutter. A pin standing under the long lever determines the depth of the cut.

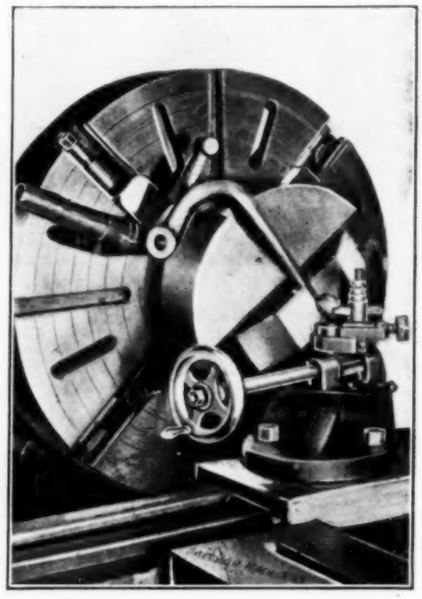


Fig. 6. Turning the Ball

Rear Axle Parts

One of the main features of the rear-axle system is the axle case, the upper and lower halves each being a steel casting. Each half is surfaced by holding it in a fixture having four dogs which secure the casting, and several backing-up screws standing in projections of the fixture, which are adjusted against the casting to steady it. Two cuts by the vertical mill are sufficient to give a good

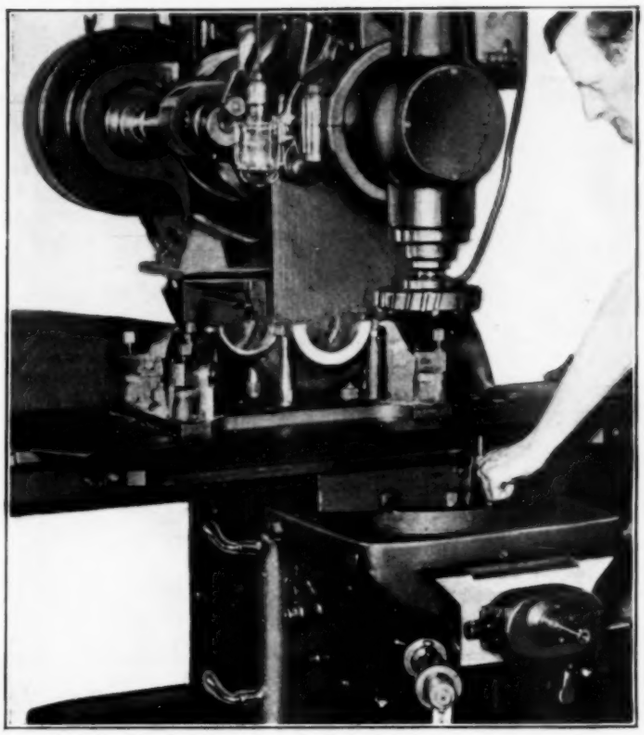


FIG. 9. MILLING AXLE CASE SHOWING SIMPLE CLAMPS

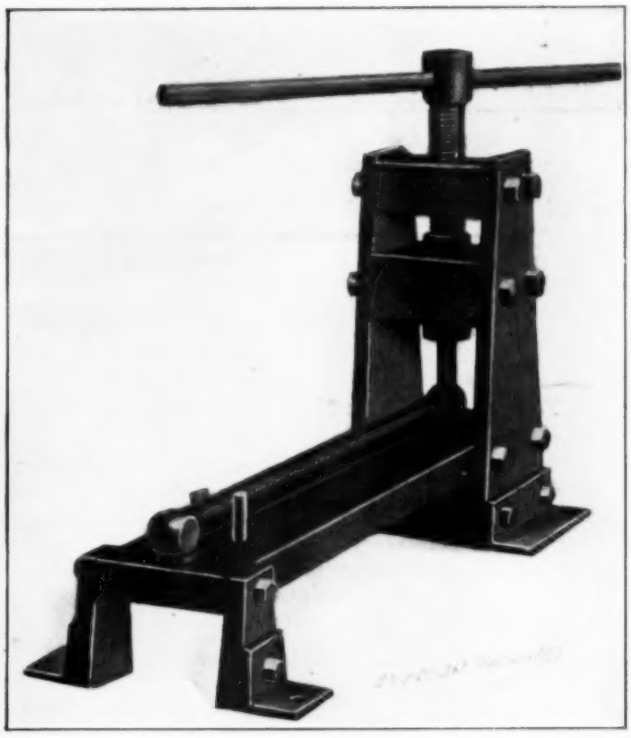


FIG. 10. SCREW PRESS FOR UNIVERSAL SHAFT PINS

joint. The specially neat clamping dogs are seen in Fig. 9.

A screw press of considerable rigidity shown in Fig. 10, is employed to insert the hardened-steel pins into the universal shaft, and it is arranged to stop when the pin has been pressed far enough through. The shaft is located on this press by a pin extending up through the base of the press. When the pin to be pressed into the shaft goes partly through and touches the pin in the press, the latter being upon a spring, is depressed through the fixture until the pin in the shaft has gone the required distance.

The cups for both ball and Timken bearings are forced into the wheels by a press, shown in Fig. 11. A fine-thread screw enables the operator to drive the cup home with great ease. After a few turns backward of the screw and a loosening of the nuts on the two standards, the yoke is rotated out of its position between the threaded standards and removed. The wheel is then removed with cup in place. The lower end of the center screw is provided with a sleeve having a long bearing upon the screw, to insure alinement. This sleeve receives in its lower end any one of a number of special forms, which are suited to the various cups employed.

The interior faces of the differential spider and cap against which the differential pinions thrust are milled by a special fixture. The spider is first placed on the fixture and then the facing tool and its housing are inserted into the hole in the bottom of the spider, and the cap is attached, also centering the housing of the facing tool. The pin is then inserted through the facing-tool spindle to engage with the spindle of the milling machine. The front end of the spindle of this facing tool has a hardened pilot, the end of

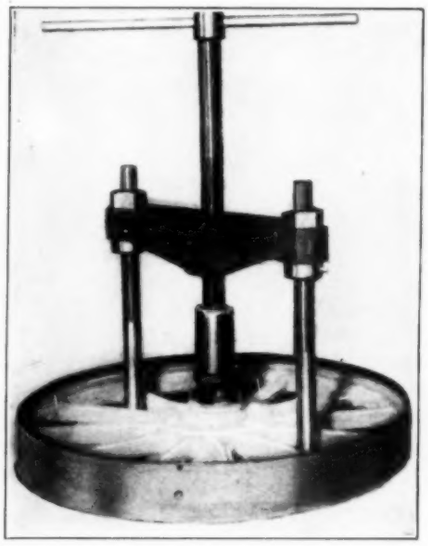


FIG. 11. SCREW PRESS FOR BEARING CUPS

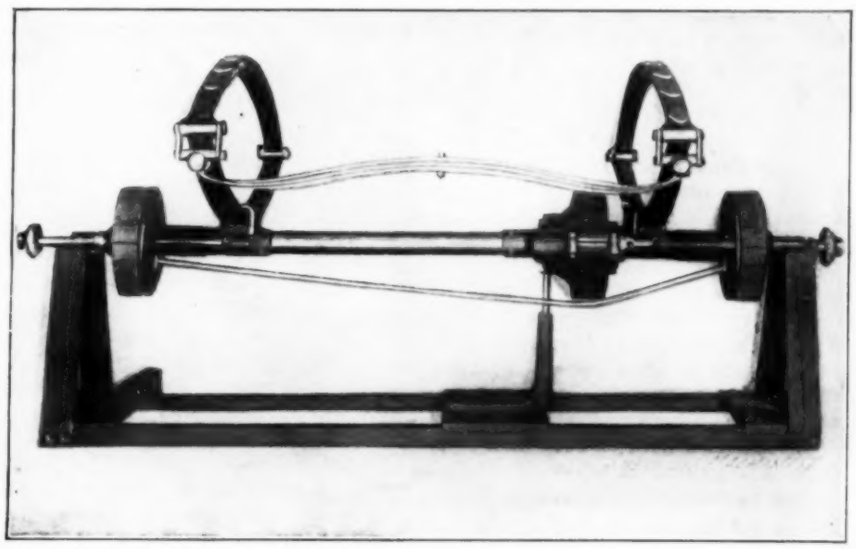


FIG. 12. FRAME FOR TRUING REAR AXLE

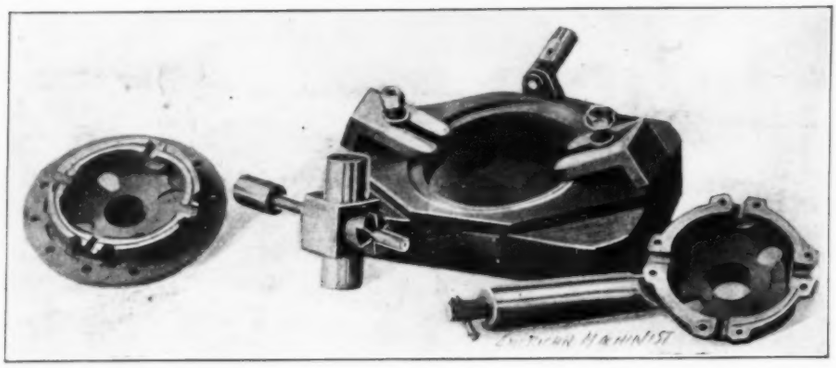


FIG. 13. FIXTURE FOR MILLING INTERIOR FACES OF DIFFERENTIAL SPIDER

which is at a constant distance from the cutting edge of this facing tool. To determine the sizes to which the facing shall be carried, this pilot bears against a pin which is indexed to determine the position of the cutter in the work. The fixture and tools are shown in Fig. 13.

TESTING REAR SYSTEM

When the rear system is fully assembled, it is placed on a testing block and run under brake load. The driving is by an electric motor, chain case and universal shaft, the same as employed on the car; thus giving as nearly the ideal conditions of service as can be obtained before the system is put under the car.

The brake shoes are cast in a circular piece, which when cut in two makes two shoes. Before the turned casting is cut into halves, it is put into a jig with thermoid lining. This jig rotates on a spindle in a housing and the thermoid lining and brake shoes are drilled at once.

When the springs have been assembled on the rear system and it is ready to be delivered to the paint room, it is put into a special fixture, and a scale is pressed on a certain point of the system by means of a spring. The reading of the scale is noted. Then the truss rod, which was formerly free and without tension, is tightened up until the system has bowed a predetermined amount, shown by the scale. By this method enough bow is put into the rear system so that when under the car, and batteries and load are in the car, the system will return to a straight line. This apparatus is shown in Fig. 12.

Electric Locomotives--Getting a Job

By John R. Godfrey

Some comments on electric locomotives and the fact that some of the steam engine devices, condemned as all wrong, are used in the latest type of electric locomotive.

The art of getting a job and a few suggestions to follow in trying to get one.

It's a mean trick to say "I told you so," especially when you didn't at all for fear you might be wrong. But it's a heap of satisfaction, when you get old enough to be bald headed, to see the latest crop of engineers going back to the old ideas which their predecessors had trotted to the scrap heap years ago.

And you don't have to be old enough to be bald to remember when Sprague and other enthusiastic electrocutors told us the old locomotive was all wrong after his dinky motor had coaxed a little car up a hill in Richmond and sounded the emancipation of the horse and the mule.

The electric motor has proved one of our greatest helps in many ways but not just as predicted. The plaintive cry for rotary motion, for the abandonment of side rods and other bad features of the old locomotive, sounded fine but they're using them on the latest electric locomotives just the same.

Instead of doing away with side rods the new Pennsylvania electric locomotives mount the motor on top of the frames, with a crank on the armature shaft. This drives at an angle of about 45 degrees to a jack shaft or axle ahead of the drivers and from the crank on this, to the two pairs of driving wheels. This makes a main rod and three side rods for each pair of wheels which is getting away from the "simplicity" idea with a vengeance.

All of which goes to show that it is dangerous to condemn any device as bad in all cases for we may have to use it ourselves some day.

GETTING A JOB

In a recent issue of the AMERICAN MACHINIST was a "Want Ad" that was unique. It read "I am a machinist and I want a job."

Short and to the point and ought to attract attention by its oddity," but I doubt if it's good advertising. It's as though a man advertised, "I make lathes and want to sell them." Would you be attracted enough to write for a catalog or prices?

The trouble with most machinists is that they are better workmen than they are salesmen and getting a job is just a case of selling your services to someone who needs them. A good salesman tells you all the advantages of his patent nut cracker and makes it so attractive that you feel a need of one and dig into your jeans for the price. In the same way, the man after a job should make his qualifications so attractive that the employer feels that he needs him and will pay a fair price for his services.

When a salesman applies for a new job he uses all the training he has acquired in selling his line to show how much use he can be. He has a line of selling talk about himself that gets him a higher salary than the mechanic who invented and builds what he sells, can command.

If you are a crackerjack boring-mill man, don't just ask the boss if he "wants to hire a new hand." Find a way of telling him that you can get out as much work on his boring mills as his best man. This doesn't mean boasting but a plain statement that will carry conviction. He doesn't want "hands," he wants men who can do things and it's up to you to convince him that you are the kind he wants.

It isn't an easy proposition by any means, but neither is anything that is worth while. Better think it over.

Recently considerable light has been thrown by Prof. Ernest Cohen, according to the *Scientific American,* upon a long recognized, though not understood, disintegration occurring in rolled or wrought tin and other metals. He has given it the name of "Tin Pest."

It has been found that below a temperature of 65 degrees Fahrenheit, tin will develop swollen, wart-like spots or blisters, which have been found to spread over the surface like a disease.

What is more remarkable is the fact that unaffected polished sheet tin can be "infected" by pieces or particles of the gray variety, so that it likewise will become "diseased."

Experiments show that wrought tin (rolled tin, tinned sheet iron, tin foil) is in an unstable condition at temperatures above 65 degrees Fahrenheit. This "wrought-metal disease," as it has been termed, also has been found to occur in other wrought metals, such as rolled brass.

Making Accurate Angle Plates

By C. L. Goodrich *

A method of making angle plates correctly by locating the work upon a suitable holder by means of two plugs whose diameters give the setting of the piece for the angle required.

How the plug diameters are computed when the center distance and angle are known.

*Department foreman, Pratt & Whitney Company.

The line drawings, Figs. 1 to 3, illustrate a method by which angular plates may be held and machined within very narrow limits of error.

Briefly, the scheme is first to plane or otherwise machine the angle plate complete, with the exception of the angular edge, and then position and clamp the plate on a holder in such manner that the angular edge of the plate, if made parallel with the lower edge of the holder by being machined, will necessitate the correct angle being produced.

The Holder for the Work

The holder, Fig. 1, should have two holes of the same diameter, and these should be carefully bored parallel with each other and square with the face of the holder. The center distance is not particular, but it must be known and a record kept. The two holes should be an equal distance from the working edge of the holder at *A*, as indicated in Fig. 2.

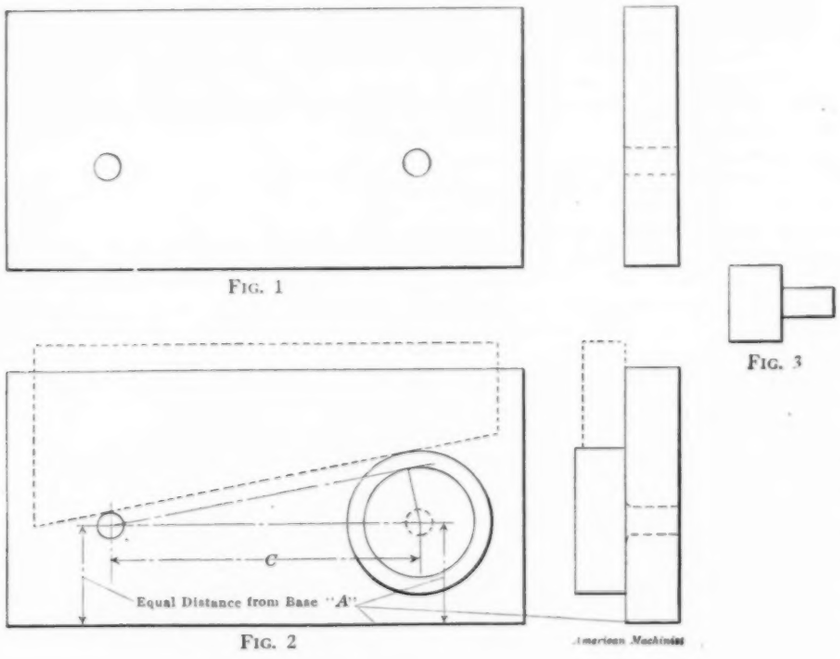


Fig. 1 Fig. 3

Fig. 2

Method of Making Accurate Angle Plates

With a holder as described, it is only necessary when planing or otherwise finishing the angle plate, to make two plugs like Fig. 3, one for each hole in the holder, with stems closely fitting the holes and with heads of proper diameters, as illustrated in Fig. 2, to enable one to machine a plate to the desired angle.

The stem and heads of the plugs should, of course, be concentric, and the table of the machine in good working condition to insure good results.

Finding the Plug Sizes

A formula giving the head diameter for the large plug is:

Two times sine of desired angle times center distance between plugs, plus diameter of head of small plug; or 2 (sin. angle) C + diameter of head of small plug.

Example:

Suppose the center distance between plugs to be three inches; diameter of head of small plug, 0.25 inch; desired angle, 10 degrees, 25 minutes.

By referring to a table of sines, find sine 10 degrees 25 minutes = 0.18081.

Then referring to the formula, we have (2 × 0.18081 × 3 inches) + 0.25 inch = 1.33486 inches.

Hence, diameter of head of large plug is 1.33486 inches.

Proportions for Small Work

For use on small jigs and gage work, the holding block should be of steel—2½ × 5 inches × ½ inch thick will be found a convenient size, with 0.25-inch holes, one inch above the bottom, or working edge. Where used continually, it is conducive to good results to harden and grind the holder.

"Cut and Try" vs. Working Drawings

There comes a time, during the development of a new machine, when there is a great temptation to let some of the details go to be worked out after the main portion of the machine has been erected. And the usual procedure in such cases is to cut out a piece which looks about right, bolt it on and then cut it down until it answers the purpose. This is "cut and try," pure and simple, and it invariably leads to expense for work and material. The portions thus cut and tried prove very costly for they have to be made over several times and interferences develop with other parts which would have been discovered and remedied had complete detail working drawings been made.

There is all too often, an excuse for this sort of work, an excuse which the workman and often the engineer is mighty glad to avail himself of when interferences begin to develop and a bracket is found to be just a half an inch "off," or a bearing develops a weakness in its supporting bracket. The excuse is the undue haste of the office to see the wheels turning round in the new machine and both workmen and designing engineer are hurried to the point where they are glad to take refuge in the "cut and try" method rather than await the slow method of making complete working drawings and catching all the "bugs" in that way.

It has often been learned from bitter experience that "office hurry" is invariably conducive to trouble and it is often a toss-up whether it is the easier to stand out and fight for time to make full working drawings, or to let the men go ahead on "cut and try" details and then have the office make sneering remarks about the necessity for doing work two or three times over. In the one instance, a man is set down as a crank, and is called pig-headed and fussy. In the other instance, it is surely handed out to him that he is incompetent and that an engineer is expected to know enough to get a thing right the first time. Otherwise, what is the use of having an engineer at all?

Machinery in Shoe Making

By S. B. Redfield

A general description of the Goodyear welt process of making shoes.

Ingenious and complicated devices which solve the problems involved in replacing hand methods in all stages of the rapid manufacture of shoes.

Problems of more than ordinary difficulty have been solved in the invention of machinery to replace long established hand methods in the manufacture of shoes.

As all know from observing the neighborhood cobbler, the shoemaker is a skilled workman and it may be wondered at that machinery could be devised to do his difficult work on so irregular and flexible an article as a shoe, as is the case in all modern shoe factories.

In order to give a very general idea of the process of making shoes, and to say just a little about some of the more interesting machines, this article gives a general description of the Goodyear Welt process, as may be found in an average factory turning out high-grade shoes, such as that of the Johnston & Murphy Company, of Newark, N. J.

To the novice, studying the process for the first time, it would seem that the shoe is built upon the insole as a foundation. The insole is a piece of sole leather, perhaps 3/16 of an inch thick, just above the outsole, and to this the upper, the welt and the outsole are fastened.

Sole Divider

Soles may be cut from the leather either by dies or by what is known as the sole divider. This latter machine is the more interesting and is suitable for straight lasts only. This device employs two curved knives, which rise and fall one after the other, the shapes of these knives being such as to cut a strip of leather transversely into right and left soles, facing in opposite directions and fitting exactly to each other, side by side.

Rounding the Insole

After rolling, the rough-shaped insoles are brought to the sole-rounding machine. This device is called upon to cut out the irregular shape of the finished insole and the problem is solved in rather a surprising manner. A wooden pattern is held in a clamp over the center of a revolving plate, and upon this wooden pattern is clamped the roughly shaped leather. By means of suitable arms, a knife is caused to travel completely around the pattern, being guided by the latter and shaving off the extra leather to give the exact shape of the wooden pattern. Rights and lefts are cut at the same time by inserting two pieces of leather, one facing up and the other down.

As the shape is so irregular, the problem of following it out with a traveling knife is one requiring considerable ingenuity, especially when it is understood that the patterns and sizes of soles to be cut by one machine must be capable of wide variation. This problem is solved by a head, which revolves around the pattern and work, at the same time that it slides in and out radially, by suitable cams, while swinging arms carried by the head and controlled by springs allow for the greater irregularities.

Channeling—No Stitches Inside

It is obvious that if the stitching should go entirely through the insole there would be roughness inside the shoe. To solve this difficulty, the Goodyear sole channeling machine has been devised. By means of this, two channels are cut extending all around the leather insole with the exception of the heel portion. One of these channels is a horizontal slit around the edge, extending inward

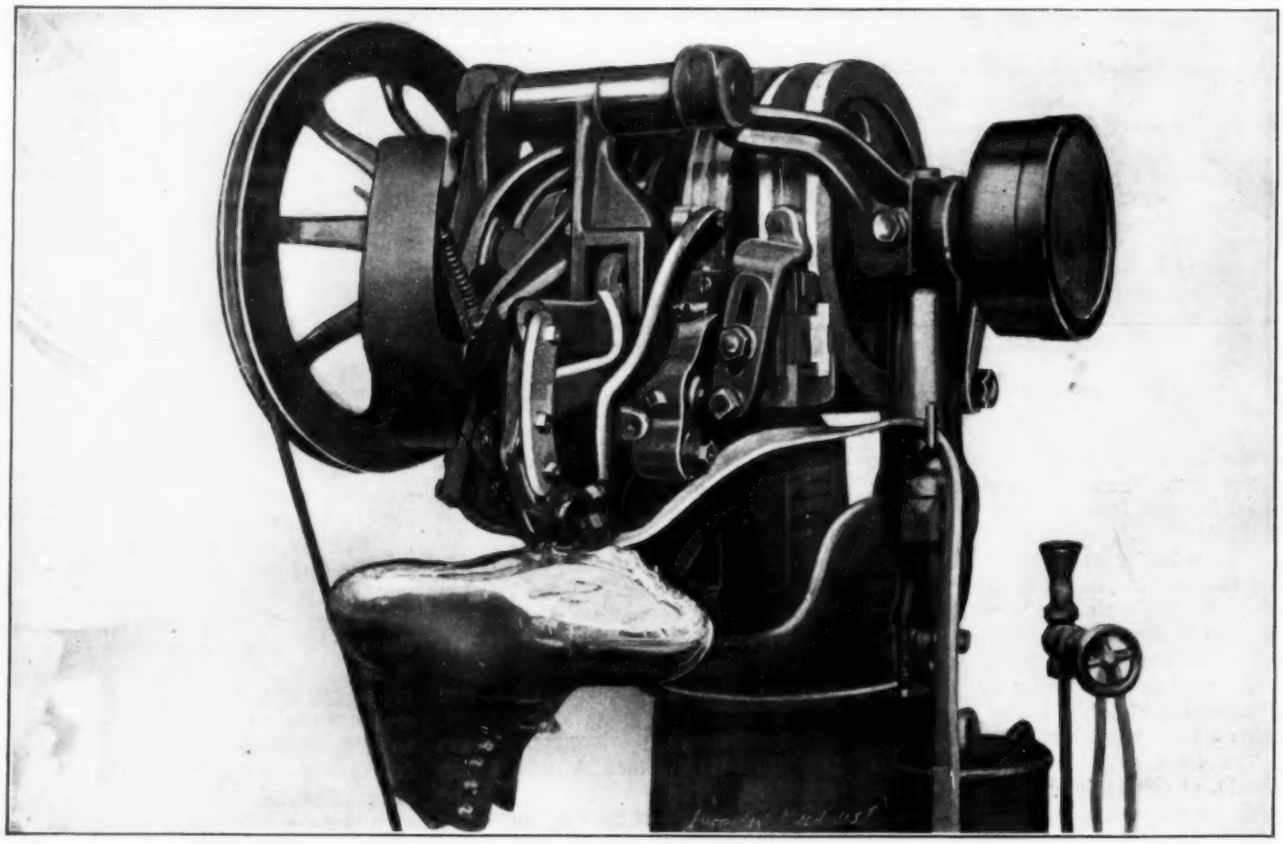


Fig. 1. Goodyear Welt and Turn-shoe Machine, Sews Welt to Upper and Insole. All Stitches Covered

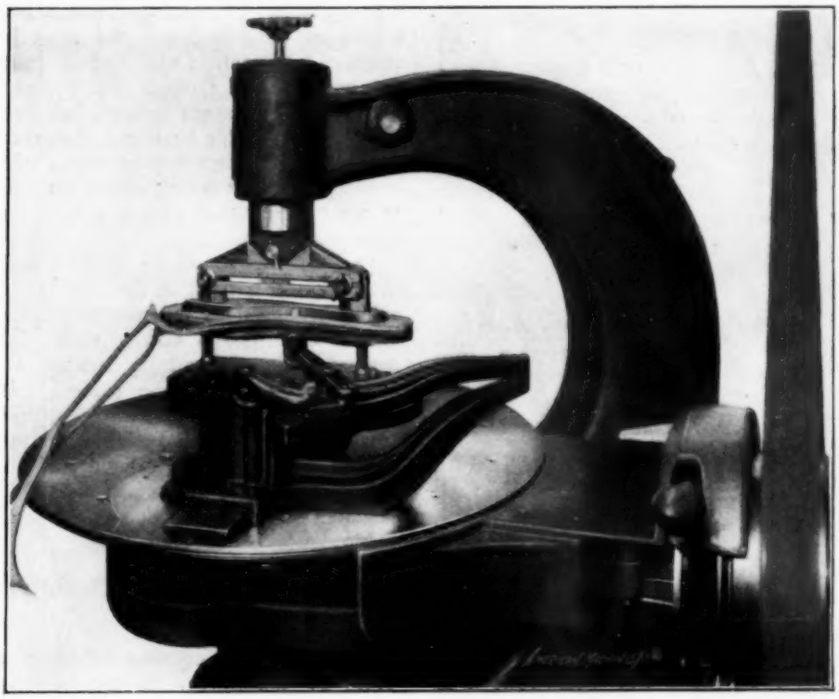


FIG. 2. PLANET SOLE-ROUNDING MACHINE. SHAPES SOLE TO PATTERN

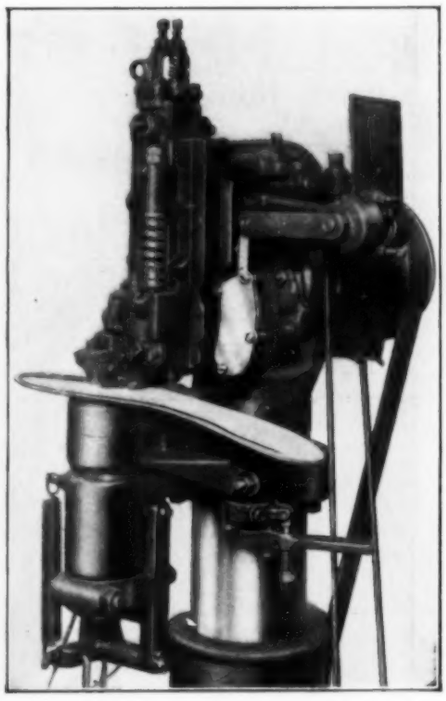


FIG. 3. GOODYEAR INSOLE CHANNELING MACHINE. CUTS CHANNELS WHICH RECEIVE WELT STITCHING

and the other a slanting slash in the opposite direction part way through the leather, around the bottom surface. It is to the thin leather lips thus raised that the upper parts of the shoe are sewed, the stitches passing only through the loose portions and thus avoiding the inside of the shoe. The depths of the channels may be varied according to pattern, by suitable guides controlled by the operator. The lips are afterward raised up by an automatic hammer known as the channel lip turner.

"CLICKING" THE UPPERS

As the uppers must next be sewed to the insole, it will be well to glance at a few of the machines used in making the upper parts. Until recently, cutting the different parts of the uppers was done by hand, the operators using metal-bound patterns, simply following out the design with a sharp knife. This is now done by the Ideal clicking machine, by which the operator stamps out the various shapes with formed knives in a press. By this means not only is the work done much more quickly, but the slip of the old fashioned patterns and the angularity of the knife as held by the operator are entirely eliminated. By suitably placing the knives according to the shape of the leather, waste of material is avoided.

Different parts of the uppers thus clicked out are next sent to the skiving machines, which by rotating knives chamfer the edges of the leather as they are guided through by the operator. Also other machines fold back these edges

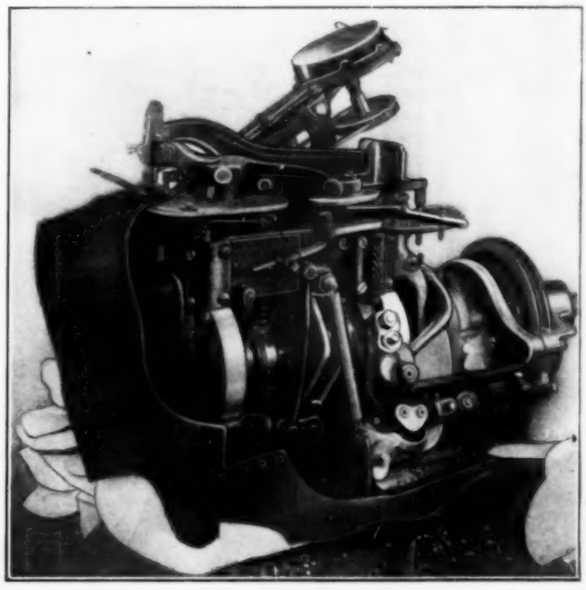


FIG. 4. EYELETING MACHINE. INSERTS EYELETS AUTOMATICALLY

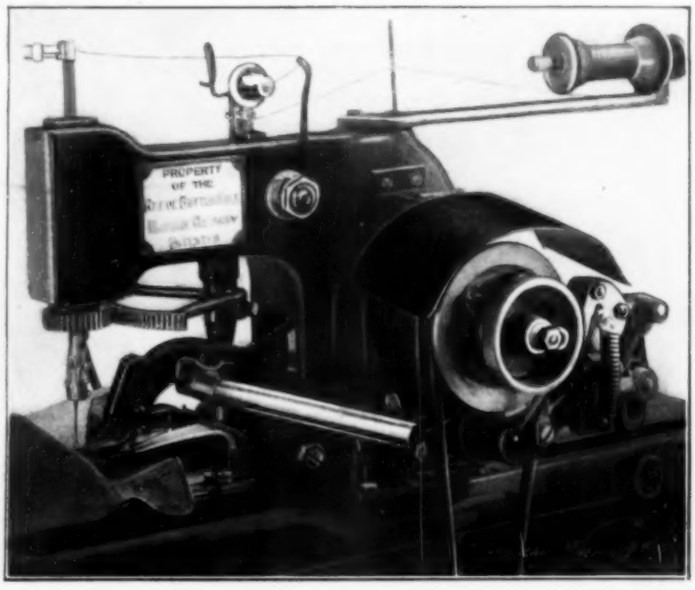


FIG. 5. REECE BUTTONHOLE MACHINE. FACES BUTTONHOLE WITH SILK THREAD AND PUTS IN BINDING CORD

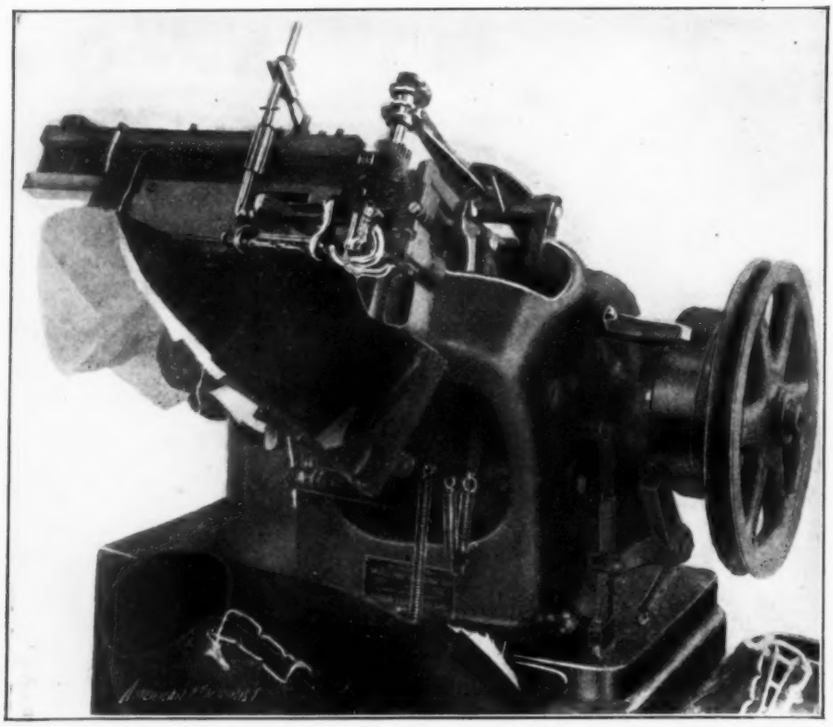


FIG. 6. ENSIGN LACING MACHINE. SOLVING A HAND-PROCESS PROBLEM

which have been glued, thus giving a finished appearance to the piece.

SPECIAL SEWING MACHINES

Various parts of the uppers are sewed together on different kinds of sewing machines, made by the manufacturers of such devices. Many of these sewing machines are special, but only two will be mentioned. One of these has two needles, and thus sews two parallel seams at the same time. Another machine has what is known as the zigzagging attachment. This is used only for those seams, notably the back seam, which are afterward to be covered by an extra piece of leather, known as a stay. Zigzag sewing puts the thread first through the material and then over the edge of the seam, and by this means it is possible to pull the seam out so that it will lie flat. The requisite strength is supplied later by the stay which is sewed over the seam. By this means the problem of making a flat seam is effectively solved.

THE EYELETS

Another interesting machine in this department is the power eyeleting machine. This device puts the lacing eyelets into the edges of the uppers. In the case of the particular machine illustrated only a single line of eyelets is put in at a time, although other machines put in the eyelets in both sides of the uppers at the same operation, thus insuring equal spacing on both sides. Even with the single machine, however, the spacing is automatic. Both the punch and the eyelet fastener have a side travel as well as the up-and-down motion, the side travel giving the requisite feed and being adjustable.

BUTTONHOLING

Still another striking machine in the finishing department is the Reece buttonhole machine. Here the problem is presented of following out the irregular shape of a buttonhole with a stitch which not only passes through the material, but which also passes through the opening to give the edge binding. Also, there is the additional complication that a third or binding cord is sewed around the edge of the buttonhole to give it a bead and greater strength.

To follow out the shape of the buttonhole, the whole head of the sewing machine is caused to automatically travel back and forth and side to side. Two needles are employed; a straight one above and a curved one below. Both needles automatically rotate eccentrically so as to always face the edge of the buttonhole while traveling around it.

The holes themselves are cut at the beginning of the operation by an automatic knife of suitable shape.

A REAL PROBLEM SOLVER—LACING THE UPPERS

At this point a problem arises to replace by machinery, an old-fashioned hand method which was not only slow, but defective. This problem is in the temporary lacing up of the upper of a laced shoe, to hold it for lasting in the form which it will have when the shoe is finished. Formerly the uppers were laced up by hand, with string, then some ingenious mind devised wire laces, which could not only be put in more quickly, but would give the correct width of opening. It is very essential to get this opening exactly as it should be when

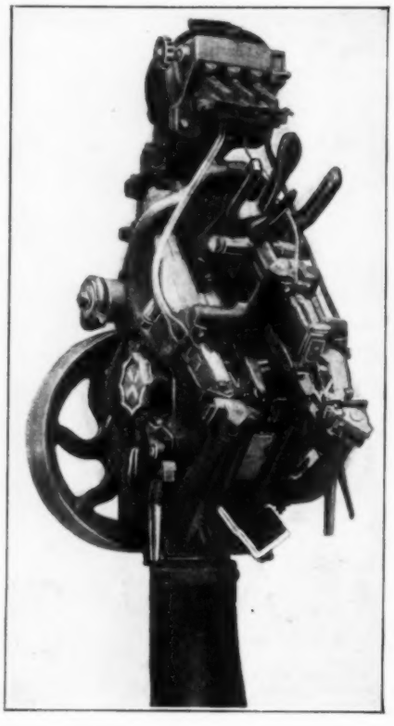


FIG. 7. REX PULLING OVER MACHINE

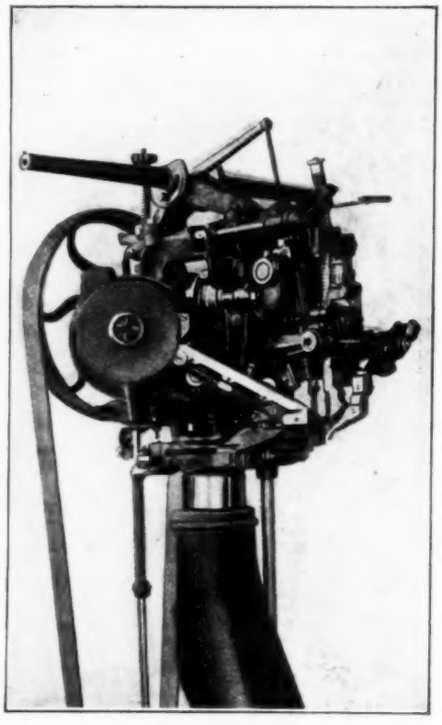


FIG. 8. CONSOLIDATED "HAND METHOD" WELT LASTING MACHINE

the shoe is placed upon the foot and it was found that hand lacing was defective in just this matter. The wire laces helped, but they were slow and also it was found that they were easily lost.

To solve this problem the Ensign lacing machine has been developed. This is shown in one of the illustrations, and it will be seen that by four projecting and one traveling needle, the string is laced through the eyelets. The string is then cut off, turned around and tied in a neat half-bow knot by a very diminutive finger and thumb. After the needles withdraw, the work drops and one lower loop of the lacing catches on a hook, the weight acting to evenly distribute the lacing and eliminating hand adjustment. The machine is entirely automatic and capable of adjustment for various openings of lacing. This is one of the machines which actually solves a hitherto troublesome problem in shoemaking.

Lasting

To return to the insole; this is next tacked upon a last and in some places this is done by automatic tacking machines. Next the upper is pulled over the last. In many places this pulling over is done by hand, but a very ingenious device called the Rex pulling over machine, has been devised to do this mechanically. By means of metal grippers, the leather is drawn tightly around the last, and five tacks are automatically driven, one at the toe and two on each side, so as to hold the leather, after the toe has been straightened and adjusted on the last, by means of compensating levers. The whole operation is directly under the observation and control of the operator. The shoe is now ready for the lasting process, which directly follows.

The Consolidated "Hand Method" welt lasting machine takes its name from the almost human manner in which it operates. Grippers catch the leather at the edges and draw it down tightly, smoothing out all wrinkles, and the machine then automatically drives a row of closely spaced tacks around the last.

In the case of hand-lasted uppers, in order to give better results in the important operation of drawing the heels and toes absolutely tight and smooth, the bed laster is sometimes used. This device can hardly be called a machine. From the illustration it will be seen that the shoe is held upon the last in the center of the device, while gripping pads and wiping plates controlled by hand levers, pull the leather tightly over both the heel and the toe. At the toe, furthermore, a wire binding strap is put on by hand, holding the crimped leather very tightly against the in-sole.

Magazine Tack Hammer

Also a number of tacks are driven around the edge of the upper with a hand-operated magazine tacking machine. This is an ingenious device which receives tacks mounted upon a paper strip, and each blow of the hammer upon its top drives one tack into the work and also feeds a new tack into the machine. All of the tacks with the exception of those at the heel are driven but part way in, because they have later to be removed. At the heel, however, they are driven home and clinched by a metal plate on the heel of the last, as at this part of the shoe the upper is not sewed to the sole, but simply tacked. After being lasted, the shoes are allowed to set in the tacked condition over night, so that they will become formed as they are tightly drawn.

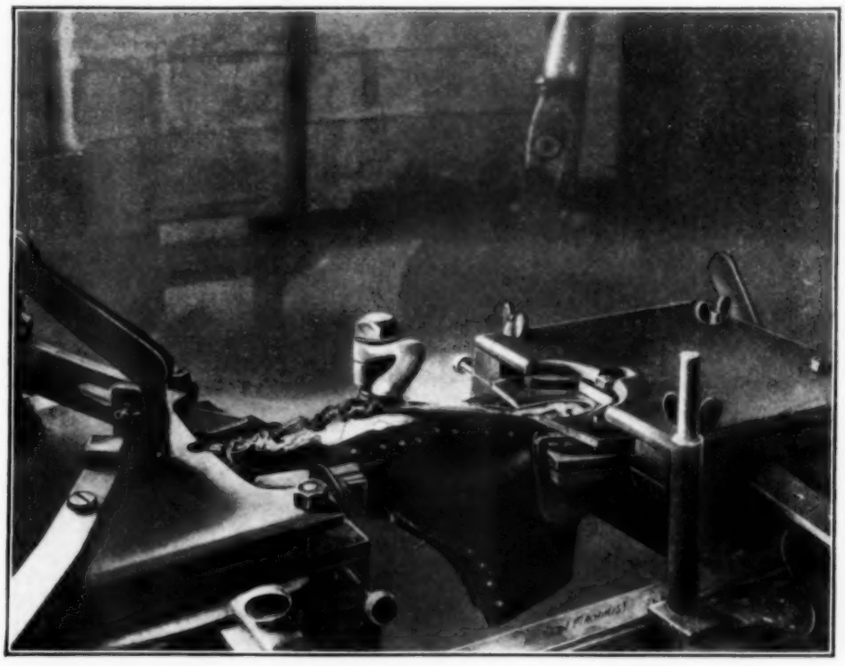


Fig. 9. Bed Type of Laster, for Drawing Leather Tightly Over Toes and Heels

Next day when the lasted shoes have become set, all of the temporary tacks are withdrawn by an automatic tack puller. At the same time this machine drives new tacks in a few widely separated places to hold the leather during the next operation of sewing on the welt. Before the welt is sewed on, however, the bottom edge of the shoe upper is run around the Rex upper trimmer to remove the surplus leather and lining material at the edges.

The Welt

Around the toe of a shoe made by the Goodyear process, from the heel forward, is what is known as the welt. This is a strip of leather about 5/8 inch wide which is sewed to the upper, extending out horizontally over the sole extension and to this the outsole is afterward stitched. Not only is it sewed to the upper, but the same stitches pass through the channel lips which were raised on the edges of the in-sole. It will thus be seen that there are several thicknesses of leather and lining materials to be sewed together in a very awkward position and the problem of doing this by machinery would seem to be almost insurmountable. However, the Goodyear welt machine, shown in the illustration, performs this operation, not only with astonishing rapidity, but with accuracy and great strength. The welt as seen from the illustration, is fed in from one side, in such a manner that it is correctly placed upon the edge of the upper and in proper relation to the channel lips of the in-sole.

In this sewing an awl first passes through the various thicknesses of leather and lining and this is followed from the other direction by a curved needle, which does not carry a thread. The end of this needle, however, is grooved to receive a thread loop, which is twisted around the end of the needle by a separate thread-laying arm, after it has passed through the leather. The needle then withdraws, pulling the thread back through the leather. The result is a strong chain stitch. The sewing cord which is of linen passes through melted waxing material, while heat is applied to the machine parts by suitable steam passages, to keep the wax from hardening.

To lay the welt out flat, it being stitched so tightly to the upper and the insole, it is next passed to the welt beater and slasher, which pounds the welt down flat away from the upper. Also at the toes, where the corner turn is sharp, the tension is taken from the outer edge of the welt by a slashing knife on the same machine, which shoots out at proper intervals.

Over the whole lower surface of the insole and welt is cemented the roughly blocked outsole. This is pressed firmly down upon the shoe on the Goodyear improved sole-laying machine. This is merely a press to squeeze the parts together while the cement starts to set.

Outsole Trimming and Channeling

After this process it is necessary to trim the edges of the outsole and the welt to conform to the shape of the sole desired. The heel portion is trimmed on a rotary knife. Trimming of the rest of the outsole and the welt, however, is done on the ingenious Universal rounding and sole-channeling machine. The operator holds the shoe in a horizontal position with the sole on edge; a horizontal knife rapidly projecting out and in trims off the edge of the sole and the welt at the same time, while a vertical knife with a vibratory motion cuts the slit or channel on the bottom face of the sole, which, when turned back, receives the stitches to hold the soles together. The stitches being at the bottom of this channel and later covered up by the lip, are not visible from the bottom of the shoe. Various guides under the control of the operator allow for variation of sole extension according to pattern.

Automatic Nailing

Next, the shoe with the cemented and trimmed outsole goes to the loose nailing machine. By means of this device, which is shown in one of the illustrations, nails are automatically driven into the "heel seat," or that portion of the sole which afterward receives the heel. An awl punches a hole ahead of the nail, which is then automatically forced in and clinched on a metal plate on the last, inside the shoe. The nail spacing is automatic.

On those shoes also which are to have heels over an inch high this machine tacks on what is known as the rand. This is a strip of curved leather which is seen in the illustration of the loose nailing machine, and its purpose is to give a flat surface to the seat to receive the heel.

The Lockstitch Machine

After this operation comes what is probably the most interesting of all; that is, the stitching of the outsole to the welt by the Goodyear outsole rapid lockstitching machine, which is also illustrated. Here two hot-waxed threads are sewed through the outsole and the welt and caused to meet in the middle of the leather in a locked stitch. This locked stitch is what we used to see the cobbler putting in when he would lean over and with both hands draw the "waxed ends" tightly, one waxed end in each hand. This motion is probably the most characteristic of the old hand methods of making shoes, and the motion which most naturally comes to mind when thinking of the shoemaker. An awl, a heavy curved needle and a bobbin take part in the sewing. It is the lockstitch put in by this machine, which makes it possible for the sole to remain firmly upon the shoe, even after the stitches have been worn from the bottom surface.

Automatic Sole Leveler

In all of the machines thus far described the operations can be termed only semi-automatic, because the operator has to guide the material through the machine, being aided usually by some pin or jack set for this purpose. It is, therefore, necessary for the operator to note carefully what he is doing and to hold the work to the various needles. In the next machine, however, the operation is truly automatic. This is the Goodyear automatic sole leveler.

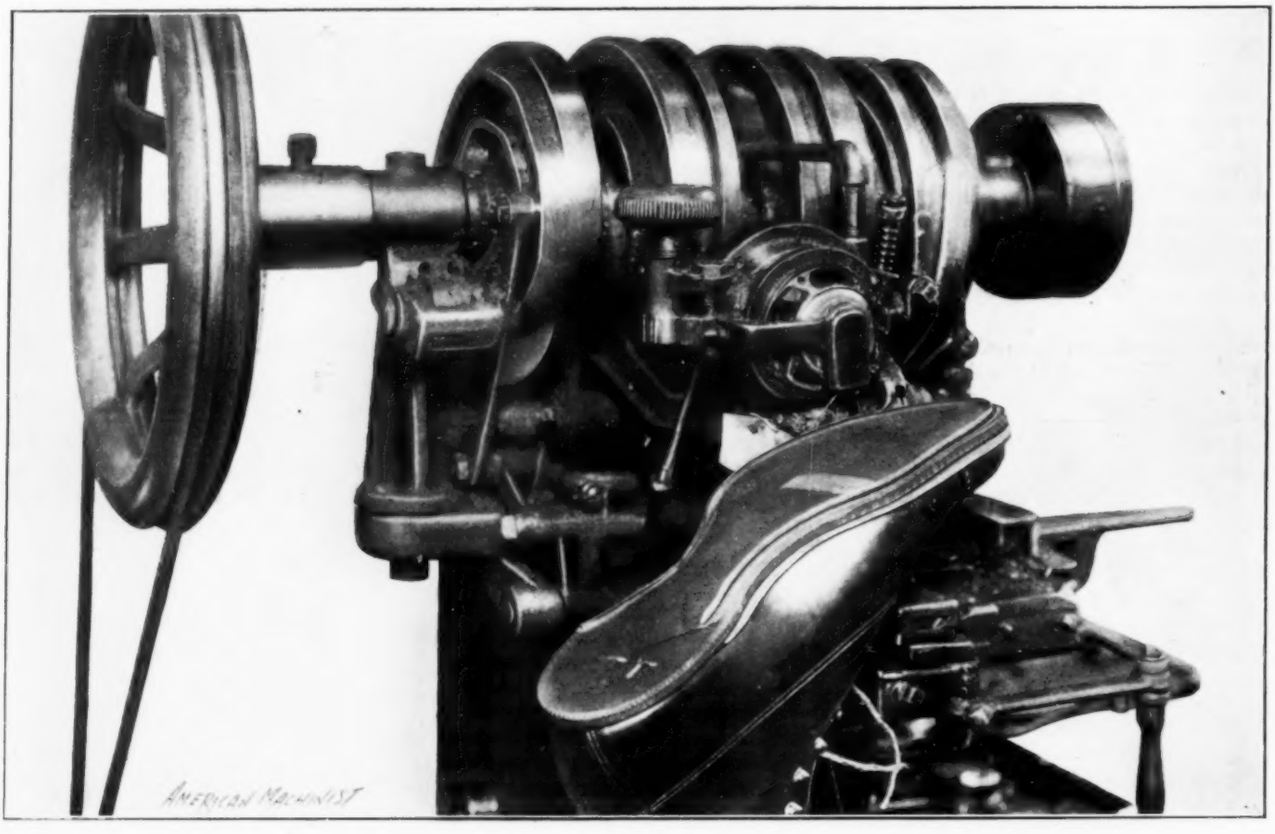


Fig. 10. Goodyear Outsole Rapid Lockstitching Machine. Sews Outsole to Welt

As shown by the illustration, this machine rolls the sole of the shoe so as to bend it in to conform to the shape of the last at the toe and in the shank. The arms carrying the rollers advance and at the same time vibrate slightly forward and back, and rotate from side to side, giving a short-stroke rolling motion over the entire surface of the sole of the shoe, passing through a complete cycle, when the machine stops.

Building and Attaching the Heels

Next we come to the process of building up the heels. The heel lifts are

stamped from sole leather by suitably shaped knives. Lifts of assorted sizes and thicknesses are assembled, cemented and put into the heel press, which squeezes them together both vertically and horizontally, making the leather dense and securing the cementing.

After this, the unfinished heels and shoes are brought together at the heeler. The machine illustrated is the American Lightning heeling machine, and by it the many nails holding the lifts of the heel together and the heel to the shoe itself, are driven at one blow. There are other more automatic types of heeling machines, but the one illustrated is conceded to be the most flexible for a general shop.

The central plate is drilled with a large number of holes combining all the usual heel-nailing patterns. Corresponding nail punches carried by the upper traveling head force the nails down into the heel lifts and clinch them inside the shoe. The particular nail pattern desired is obtained by a templet upon a swinging plate, into which a helper inserts the requisite nails. Swinging the plate into the machine automatically drops all the nails into the holes under the punches, their arrangement being determined by the templet used. The heel lifts are held in place by spring fingers under the main plate.

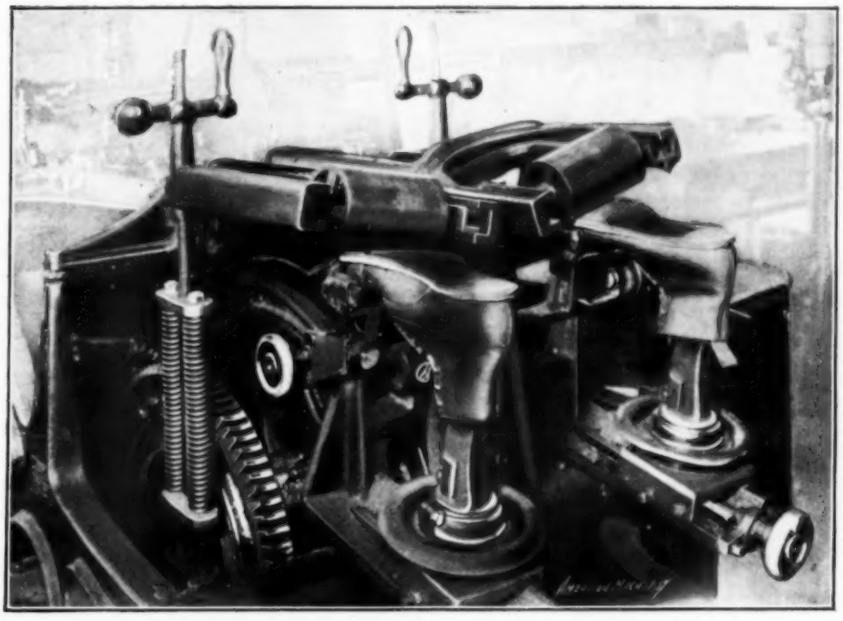


FIG. 11. GOODYEAR AUTOMATIC SOLE LEVELER. SHAPES SOLE TO LAST

The nails are not driven completely down, but stand up above the heel about 3/32 of an inch. The next operation is to swing a set of fingers at the back of the machine, which bring the "top lift" or outside layer of the heel over the shoe, and another application of the pressure forces this down over the projecting nails, causing them to enter the leather backward and hold this top lift in place.

UNIVERSAL SLUGGER

Next, what are known as the wire

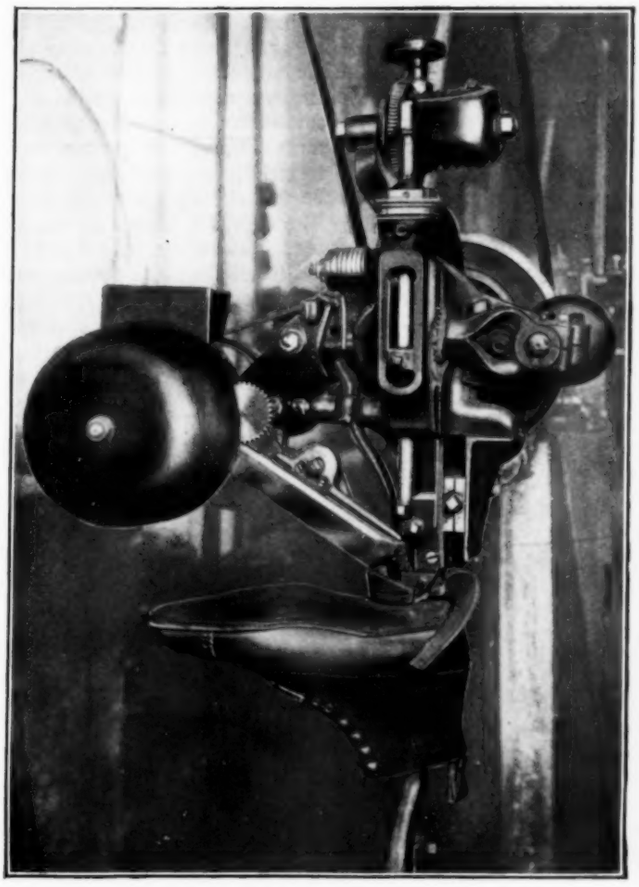


FIG. 12. LOOSE NAILING MACHINE. DRIVES TACKS AUTOMATICALLY FROM MAGAZINE

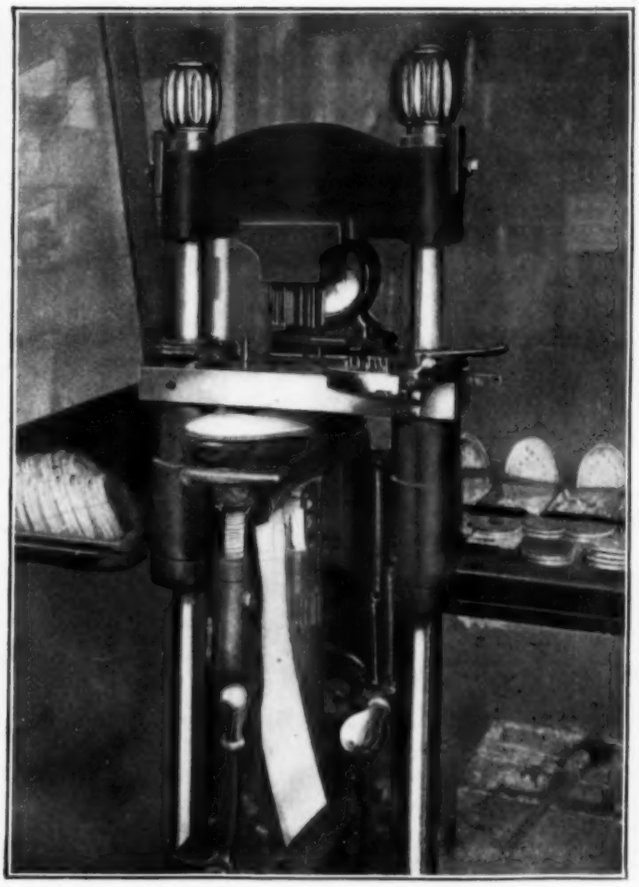


FIG. 13. AMERICAN LIGHTNING HEELING MACHINE. DRIVES ON THE HEELS. HEEL LIFTS AT LEFT. NAIL TEMPLETS AT RIGHT

slugs are driven through the different lifts of the heel to hold the top lift and also to give wearing surface to the edges. They are put in by the Universal slugger. This is a most interesting machine, as the slugs are fed from coils of wire overhead. The feed of the wires and also of the shoe to be nailed, is automatic and continuous as long as the machine is in operation. It can be arranged to drive single or double rows of slugs around the heel rims. Cutting off of the slugs is done close to the heel by chisels, which are driven in from each side, the motion of these chisels, as of all the other parts, being entirely automatic.

At this point all of the parts of the shoe have been assembled, and it only remains to trim and finish them. The edges of the sole and heel are further trimmed on rotary knives by the edge-trimming machine, while the shoe is held in the hands of the operator. The front edge of the heel is trimmed off by a vertically traveling knife on the breasting machine.

Finishing Touches

Further finishing is done on sandpaper wheels, and after this, color is applied to the sole edge and waxing and burnishing is done by hot irons which are kept in a continuous state of rapid vibration. It is this polishing operation which is so interesting to watch in the cobbler's shop when he rubs the hot iron around the sole edges. These machines are called edge-setting machines.

The Miller treeing machine is used to remove all wrinkles from the upper, an expanding tree holding it taut while the operator smooths the surface with a hot iron.

There is also another machine known as the "Xpedite" finisher, which applies wax to the surface of the heel by means of rotating segments, which actually beat the wax into the leather. A brush on the same machine afterward gives the high polish. Other sanders, burnishers and buffers remove stains and put on the finishing touches and the stitch separating machines make indentations on the welt surface of the sole extension, to give an attractive appearance.

Most of the machines mentioned are manufactured and leased by the United Shoe Machinery Company, of Boston, Mass.

Some Methods Used in a Vise Shop

By E. A. Dixie

How the casting of vise jaws, in which the steel face is welded, is accomplished. Casting ball ends on screws and milling sliding jaws.

The casting of vise jaws in which the steel face is welded, or to use an old term, "burnt on" the casting, seems to be considered a secret by many visemakers, but through the courtesy of Mr. Kuhn, general manager of the Emmert Manufacturing Company, Waynesboro, Penn., I am able to show the way this and other interesting work is done in their shops.

The tool-steel faces are first cut to length and rough ground all over so as to clean them. They are then tinned in the usual way with muriatic acid and melted tin to keep them from rusting.

Figs. 1 and 2 show respectively the drag and cope of a vise mold. The pattern is made to leave a place in the mold for the core *B*, which is shown in place in Fig. 1, and separate in Fig. 2, and for the tinned-steel jaw face *A* which is shown in place in Fig. 1. The iron when poured strikes the drag at *C*, runs into the hole in the core *B* and out through the narrow slot in *B* past the jaw *A*, gradually heating it to a welding or "burning on" heat. The slot in *B* is about 1/16 inch wide. After the mold is full a certain amount of iron is still poured, which flows past *A* and brings it to the right heat. The amount of this extra metal is governed by the size of the vise and the heat of the melted iron, the molder through long practice being able to gage the quantity necessary. Fig 3 shows a line of molds ready to pour. The extra metal runs up through the riser *E* and along the gutter, falling into the trough *F*.

Casting Ball Ends on Screws

In practically all vise shops it is customary to cast the ball ends on the screws in green-sand molds. If the molder works hard he can probably close a mold every 10 to 15 minutes. The ball ends cast in green sand are finished in the lathe which, of course, adds some expense to the product.

Fig. 4 shows a chill in which the ball ends are cast at the Emmert Manufacturing Company. The screw *A* has two grooves forged in it as shown. It is then dipped in red lead mixed with turpentine. The chill *B* is hinged as shown. The screw is held in the hole *C*. The hole for the handle is made by the core *D*. The iron is poured in at *E*. The hook *G* locks the two halves of the chill together while pouring. In this chill a ball end can be poured and knocked out in

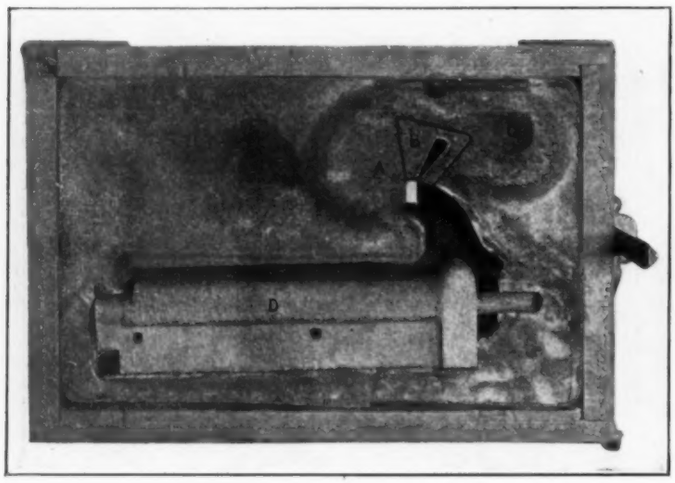


Fig. 1. The Drag

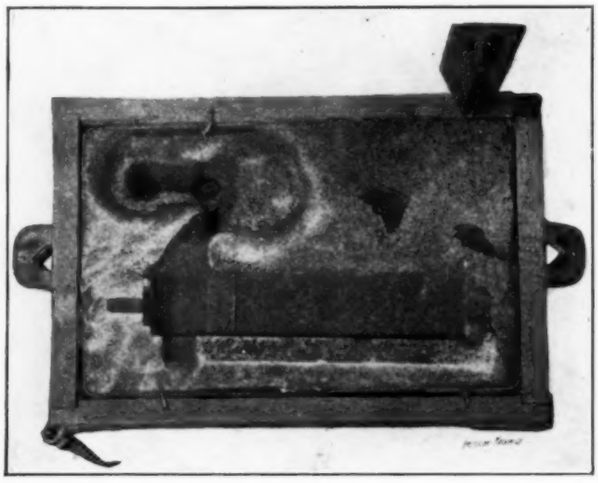


Fig. 2. The Cope

FIG. 3. A ROW OF VISE MOLDS READY FOR POURING

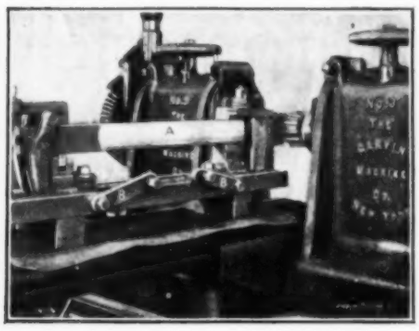


FIG. 5. MILLING A SLIDING JAW

less than a minute. The chilled ball end needs no turning but is finished by grinding the fins off and while a less expensive job is stronger and holds to the screw better than the green-sand molded end. Fig. 5 shows a Garvin duplex milling machine finishing at one pass two sides of a sliding jaw. The jaw *A* is put on the supports and the two gages *B* are swung to vertical position. With *A* against these, the clamps are tightened, after which *B B* are dropped out of the way of the mill.

The top and bottom of the slide are milled in precisely the same way but with the jaw lying on its side. The ends of the jaws are milled simultaneously with a pair of end mills with inserted cutters in practically the same manner.

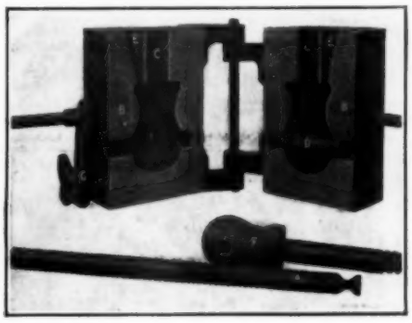


FIG. 4. CHILL FOR BALL ENDS

In 1902 the annual output of all electric stations and electric railways in the United States amounted to 4,768,535,512 kilowatt hours. In 1907 the output of the two classes of stations was 10,621,406,837 kilowatt hours, the increase in that year as compared with 1902 being 5,852,871,325 kilowatt hours, or 122.7 per cent.

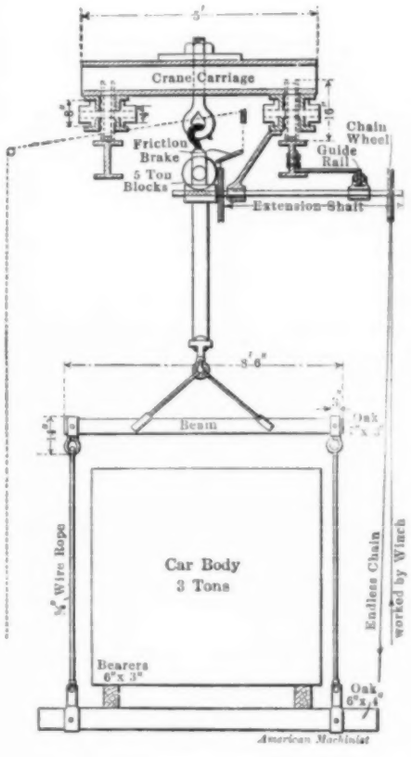
A Homemade Car Crane

By H. Vernon

As a reader of the AMERICAN MACHINIST, and one who is always interested in noting how difficulties are overcome by practical men, I submit sketch showing method by which a pair of 5-ton chain blocks have been in use for 4 years, during which time they have lifted, traversed and lowered, some 200 tramcar bodies, without the slightest hitch or trouble.

The principal peculiarity about this fixture, is that the blocks are worked by a chain-wheel spindle extended out 5 feet from the blocks, so that the hoisting chain will not rub against the car paint work, and the men operating the chain would be clear of the weight when lifting or lowering. On this spindle is fitted an extra wheel to which a friction brake is attached, which can be used in case of accident to lifting chain clutch. These blocks are worked by passing the hoisting chain over the drum of a portable winch, which is operated by two men off the floor level. By its use we are able to lift the car body from the main floor to the top shop; a distance of 19 feet, in 20 minutes. As this crane is in use only about once per week, the time taken for the operation is not of much moment, the weight lifted is a very awkward one, and the space at our disposal limited.

The general design and purpose of this homemade lifting and traversing crane, warrant space in your valuable paper.



HOMEMADE CAR CRANE

The new tramcar bodies having to be constructed in the upper story of the body making shop, the arrangement for lifting, and carrying them out of that shop, consists of two steel I-beams 14 by 6 inches by 32 feet long, placed 4 feet apart, on two specially constructed steel principals, fastened securely to the compound-steel beams, which support the roof of the building. On the top of these beams are placed the rails on which the lifting carriage runs. This carriage is made up of four pieces of channel iron 9 by 3 inches by 5 feet, two on each side, and between each two are placed the wheels.

Across the top of the carriage are fastened two steel beams 9x5 inches, to which are attached the chain blocks. The car bodies are lifted on a specially constructed cradle, composed of a cross beam for fixing to hook of chain blocks, from which are suspended the shackles. From these hang four 5/8-inch steel-wire ropes and hooks, (the ropes are leather covered). These hooks engage the cradle at each corner, so that the body when lifted is perfectly balanced. The carriage is traversed by means of chains fastened to either side; these chains pass over pulleys at ends of beams, down to crab winches fastened to the wall. The material for the construction of this crane was on hand, so the only cost was the time spent on the manufacture and erection.

Automatic Screw Driving Machine

By John A. Rutter

A home-made machine which automatically feeds the screws from a magazine to the screw driver spindle which is rotated continuously and drives the screws home in the work when the foot treadle is depressed.

Arrangement of the driving mechanism and the magazine and chute by which the screws are supplied to the screw driver as rapidly as required for running into the tapped holes in the work.

In manufacturing some of our specialties it was necessary for us to use a great number of machine screws and as they were mostly about an inch long it required a great deal of hand work to put these in place. The firm did not care to invest in regular screw-driving machines, but still thought there should be some way except by hand to do this work. They spoke to me about it and the machine shown herewith was the result.

The Spindle and Its Bearings

We had in the shop several cast-iron frames for riveting machines, so I used one of these for the frame of my screw-driving machine. The spindle *A* was first designed. Fastened to this is the pulley *C* which is driven by a belt taken from the countershaft and around the idler pulleys *B*. This revolves the spindle and consequently the screw driver. Fastened in its lower end *D* is a phosphor-bronze bushing inserted in the frame and cut out so as to form a bearing for the shoulder on the pulley *C*. *E* is a washer fastened to the bushing to hold the pulley in place. *F* is another phosphor-bronze bushing serving as a bearing for the spindle. *G* is a hardened-steel washer acting as a stop for the lever *H*, and *I* is a steel collar which is pinned to the spindle and is of such a shape as always to rest on the jaws of the lever *H* when revolving. Inside the frame are the levers *H* and *J*. Connected to *J* is a rod *L* running to a foot lever on the floor. The spring *K* is applied to *L* to break the sudden shock as the foot lever is pressed. *X* is another spring to pull the levers back into place when the foot is removed.

Pressure on the foot lever pulls down the rod *L*, the spring *K* breaking the sudden jolt, and the levers *J* and *H* act upon the collar *I*. This moves the spindle down until the screw driver engages the screw and puts it into place. The collar *M* is movable for the purpose of regulating the downward movement of the spindle. When the foot is removed the spring *X* draws the levers back into position.

The Automatic Feed Drive

Fastened to one of the idlers *B* is the pulley *N* and directly below *N* is another pulley *N'*. A bearing was secured for *N'* by first drilling and tapping holes in the frame. A piece of steel *O* was screwed into each of these holes and bored out. Then the bearing sleeve *P* was made and fastened in *O* by set screws. The shaft *Q* was run through *P* and the pulley *N'* was mounted on this and held in place by collars. Fastened on the other end of *Q* is the pulley *R* for a round belt. The cast-iron support *Y* supports another shaft on which is fastened the pulley *U*. This shaft runs up and revolves the bottom plate in the magazine *T*. A quarter turn round belt connects the pulleys *R* and *U*.

The Guide Chute from the Magazine

Running up through the side of the magazine *T* is the track or chute *V*. This is of two pieces of steel arranged with

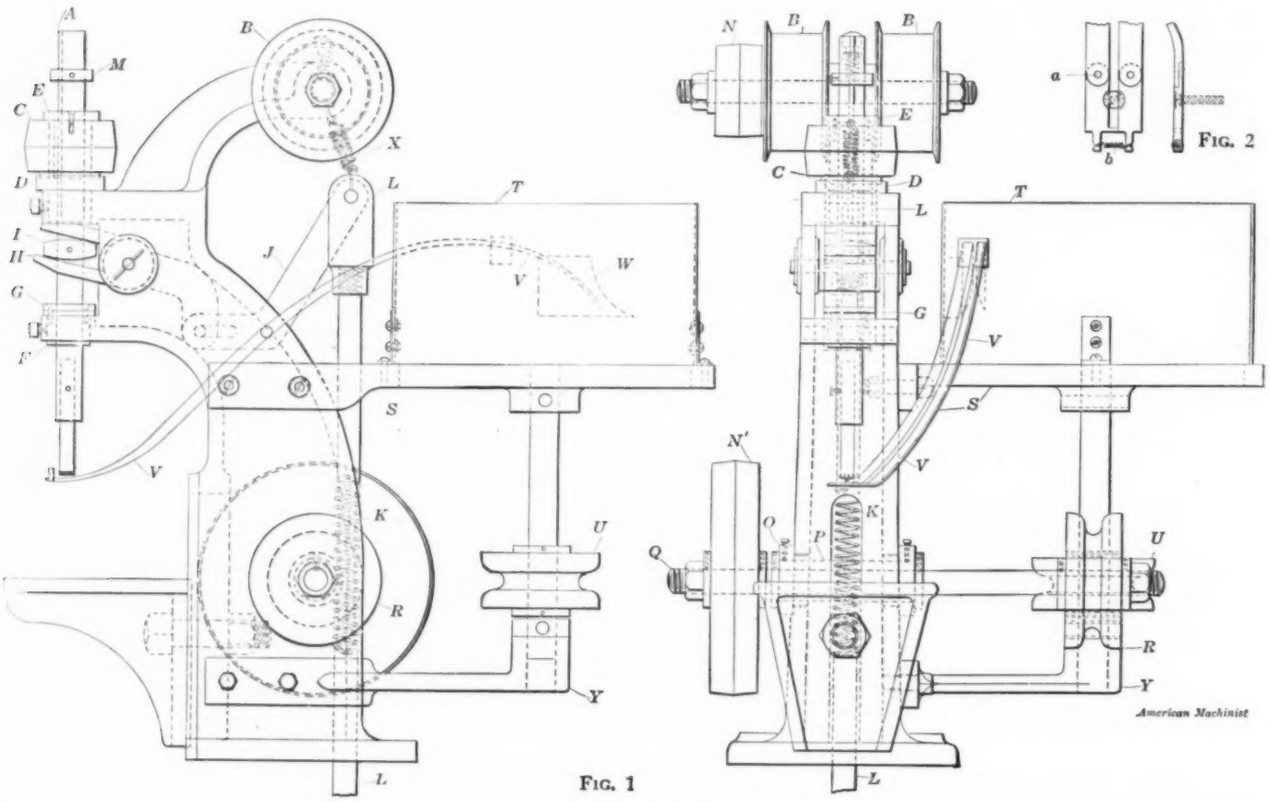


Fig. 1

Automatic Screw-driving Machine

Fig. 2

the space between them a trifle more than the diameter of the screw. The chute comes out of the magazine and curves downward under the screw driver. The end in the magazine widens out a little to catch the screws more readily. *W* is a piece of steel fastened to the side of the magazine and shaped so as to throw the screws revolving around the side of the magazine on to the chute. The magazine itself is of ⅛-inch sheet iron fastened on the support *S*.

The end of the chute under the screw driver is arranged as shown in Fig. 2. The head of the screw drops into the countersunk hole and as the screwdriver comes down it pushes the screw head against the sides of the tapered hole and forces the sides of the chute open sufficiently to allow the head of the screw to pass through. The chute is pivoted at *a* for this purpose. As soon as the screw head is through and the screw is in place the screwdriver is withdrawn and the spring *b* snaps the guide chute shut again. The next screw, through the pressure behind it, is forced into the hole ready for the next operation. A screw is shown in the illustration dotted in position ready for the screwdriver.

The Stop Setting

The stop *M*, Fig. 1, must be located so that when the screwdriver has left the head of the screw, the screw will be completely in place. The screw tends to feed itself away from the screwdriver as long as the two are engaged. Therefore *M* must stop the downward motion of the spindle when the screw is all but the depth of the slot in position, or the distance between *E* and *M* when the screwdriver is up is equal to the distance the screw is to go in minus the depth of the slot in the head.

Operation of the Machine

The magazine *S* is partly filled with screws and through the system of belts explained the bottom in the magazine is revolved and this stirs up the screws and throws enough of them into the chute to feed the screwdriver. They slide down the track into the hole beneath the screwdriver. The receptacle for this screw is placed on the table of the machine below the screw. The stop *M* is properly set and the foot lever pressed, which through the levers *J* and *H*, drops the spindle and screwdriver. This catches the slot in the head of the screw and puts the screw in place. The foot is removed, the spring *X* pulls back the levers and screwdriver, the next screw falls into place and all is ready for the next operation.

Cabinet for Blueprint Paper Roll

By E. M. Kenan

Details of a blueprint cabinet that serves a very useful purpose as well as forming a piece of furniture for the drawing room.

This case, when designed, was intended to be a piece of drawing-office furniture and not a common packing box to be thrown away in some dark corner until wanted. It is for holding the blueprint paper roll.

Fig. 1 is a front elevation, and Fig. 2 a cross section. It is neat in design and has in its construction a few features not common in boxes that are made for this purpose. The lumber used is mahogany. The ends, sides and cover are ¾ inch in thickness and the bottom one inch in thickness. The cover is made with a ⅝x1⅞-inch rib that fits down over the case, as shown in the section, Fig. 2. The purpose of this rib is to help keep the cover from warping or twisting. A felt pad is secured to the cover with glue, the pad practically excluding light. The cover is weighted down with a few catalogs and reference books.

Secured with screws to the bottom edge of the front panel is a brass plate 1/16 inch in thickness and 1¾ inches wide. Between this plate and the bottom board is a space equal to the thickness of three sheets of drawing paper and 1 inch longer than the width of the paper. In the bottom board, and parallel with the front edge of the brass plate, is a recess (shearing gutter), made with a circular saw. This is about ⅛ inch wide by 5/16 inch deep.

Secured in holes bored in each end of the case, and shaped as in Figs. 1 and 2, is a pressure bar made from 3/16-inch steel. This bar is 3½ inches out from the front and the end turns about 3 inches from the end of the opening. In the brass plate are two half-circular openings cut out which provide a means of starting the paper, as shown at *A* and *B*, Fig. 3.

The ends, sides and bottom are securely put together with glue and screws and in each corner is a leather fillet. The outside of the case is finished in the natural wood and the inside is given four coats of black varnish (shellac, alcohol and lamp black). The dotted line *C* shows the tracing, and *D* the print paper. Both are drawn out together under the pressure bar, until the tracing passes the edge of the brass plate, where tracing and print paper are held together by the bar, while a knife blade is drawn through the paper along the brass edge.

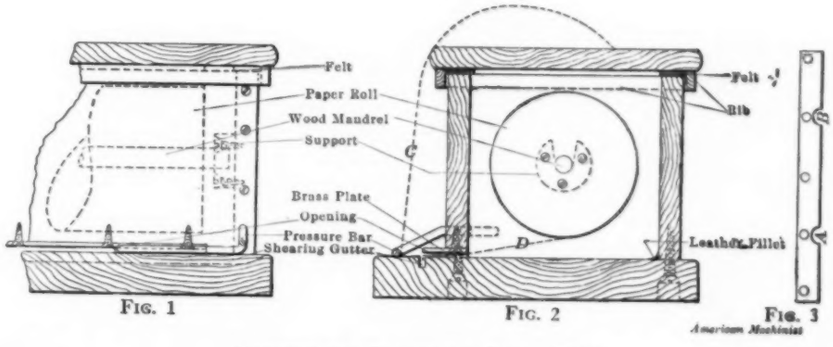


Fig. 1 Fig. 2 Fig. 3

Cabinet for Blueprint Paper Roll

There is no better course of study for any apprentice or other young mechanic than to become as familiar as possible with the many names and terms used in the shops. While these vary in different sections, there are always enough mechanisc floating from State to State from whom to learn many of the local terms with little trouble. While it would be difficult to put a pay-day price on this knowledge, no one can fail to be of more value who can call a tool or part of a machine by its right name, rather than to designate it as a "thing," preceded by one or more lurid adjectives.

In a series of tests conducted by Italian engineers to ascertain the hardness of copper, tin and lead bronzes it was found that the bronzes high in tin were too hard for use as bearings and the conclusions derived were that only those containing 10 per cent. or less were suitable for that purpose.

Lead Lined Tubing

By Holden A. Evans*

A troublesome problem in steel war vessels has been the preservation of salt water piping. A recent solution, far superior in results to any of its predecessors, lies in lining steel tubing with lead tubing about 0.1 *inch thick. Special machinery has been developed whereby the lining is drawn into place, pressed into intimate contact with the steel tubing, and capable of handling even the most difficult bends quickly, surely and at small cost.*

*Naval constructor, United States Navy.

The rapid advance in recent years in warship construction has presented many new problems for the constructor and the engineer to solve. New requirements and new conditions have in the majority of cases been satisfactorily met, but in some cases—which on the surface might appear simple—it has been the old saying, "Try, try again until success is attained."

One of the troublesome, but apparently simple problems, has been the preservation of salt-water piping. In the old days with ships with no electric plant, or even later in wooden ships with an electric plant, this question presented no difficulty. With salt-water piping of copper, no trouble was experienced, and the life of the piping was almost the life of the ship. In fact, so little trouble was experienced that the principal salt-water systems were made of galvanized iron or steel and the piping lasted for years.

In modern steel ships with large electric plants electrolysis played havoc with the salt-water piping and in many cases the fire and flushing systems were in bad condition, requiring extensive repairs or renewals, after a few months' service. Both the fire and flushing system are indispensable to a warship. The fire main runs practically the entire length of the ship behind armor and under the protective deck. Throughout the greater part of its length it is in duplicate, these being cross connected at several points. Numerous risers reach every part of the ship. The system is fitted with numerous cut-out valves, so that if any system is damaged in action, that section can be cut out and the remainder of the system used. Recent wars have shown the great danger from exploding shell, and if means are not at hand for suppressing these fires as soon as started, defeat is sure. The fire system is, therefore, of the utmost importance.

The flushing system extends practically the full length of the ship, and is used for flushing the lavatories, wash rooms, etc., of the officers and men, and is nearly as important, for sanitary reasons, as the fire system.

The cost of the installation of these two extensive systems of piping is large and constant repairs and renewals involve a large expenditure of money. The frequent withdrawal of ships from active service for repairs also greatly reduces the military value of the ship.

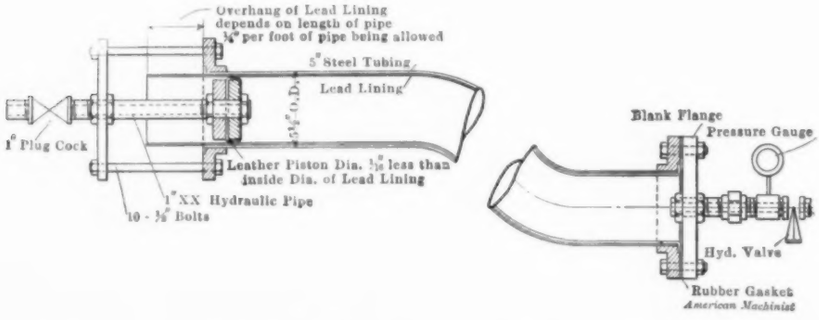

Overhang of Lead Lining depends on length of pipe ¾" per foot of pipe being allowed
5" Steel Tubing
Lead Lining
5½" O.D.
1" Plug Cock
Leather Piston Dia. 1/16 less than inside Dia. of Lead Lining
1" XX Hydraulic Pipe
10 - ½" Bolts
Blank Flange
Pressure Gauge
Hyd. Valve
Rubber Gasket
American Machinist

FIG. 1. DETAIL OF PLUG FOR CLOSING END OF PIPE BEFORE PUTTING ON HYDRAULIC PRESSURE

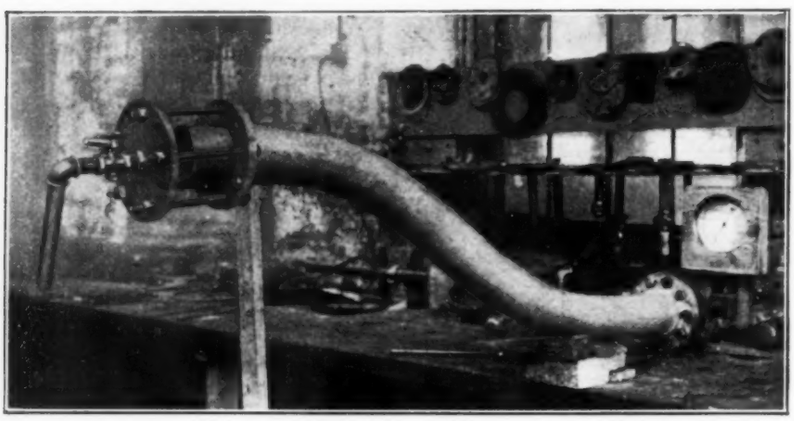


FIG. 2. EXPANDING THE LEAD BY WATER PRESSURE

STEEL, BRASS AND COPPER PIPE UNSUCCESSFULLY TRIED

In the past 20 years galvanized iron or steel pipe, brass pipe, and copper pipe, protected with numerous zinc boxes have been tried. All three were about equally unsatisfactory. In some ships the life of the piping might be 18 months, while in a sister-ship it would give trouble after six or nine months' service.

LABORATORY EXPERIMENTS FAIL TO SOLVE THE DIFFICULTY

About 10 years ago it was thought that the problem had been solved. Prof. A. H. Sabin, after long experiments, found that piping carefully enamelled with a coating which he had perfected would resist the deterioration which had taken place in the past. To apply this coating the piping was carefully cleaned, dipped into a tank of hot liquid coating and baked at a constant temperature. This method was expensive and required considerable care. Professor Sabin's coating was extensively used in the navy for several years.

There is no doubt that the coating properly applied prolongs the life of the piping. In practice, however, it was found impossible to secure a coating which would adhere and in nearly all cases the coating, after a short time, flaked off and filled up the small branch pipes and seriously interfered with the operation of valves. The removal of the coating in spots localized and intensified the corrosion in these spots and the piping was soon eaten entirely through. After exhaustive trial with every effort made to secure a uniform permanent coating, it was evident that Sabined piping possessed no appreciable advantages over piping previously used.

Copper piping was again used, but it was tinned on the inner surface, and

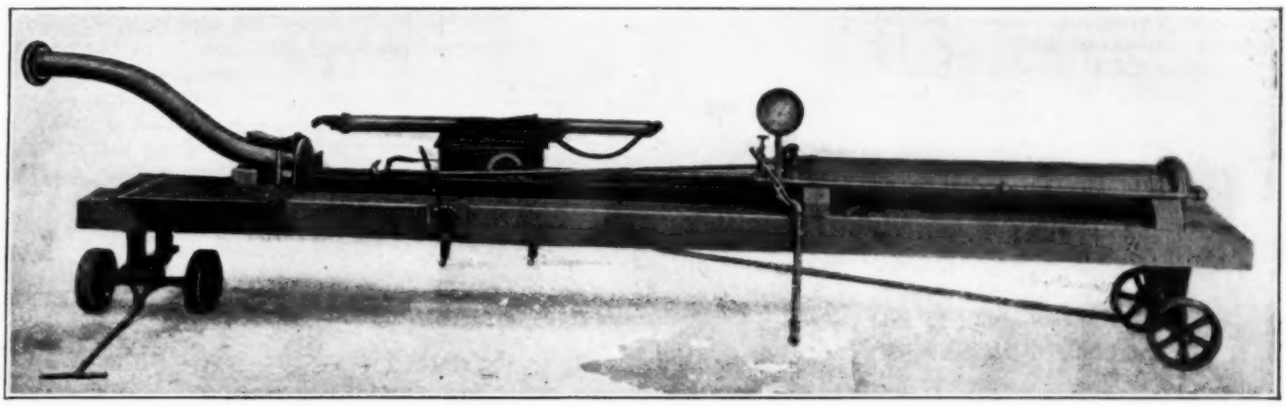


FIG. 3. MACHINE FOR DRAWING THE LEAD LINING THROUGH THE STEEL TUBING

protected with zinc boxes located in the main 20 to 30 feet apart. The zinc boxes and the tinning added to the life of the pipe, but the tin coating soon disappeared and the piping could not be depended on for more than a year.

LEAD-LINED PIPE

About the time of the beginning of the use of the Sabin coating one ship was fitted with iron pipe, lined with lead. The piping used was very heavy, and extra weight is a serious disadvantage in a warship. This pipe was fitted with the ordinary screwed connections. In a very short time the pipe gave out and it was found that at the joints the salt water had gotten behind the lead lining and active corrosion had taken place. The lead was also not in intimate contact with the iron and the water had in some cases penetrated the entire length of the pipe behind the lead lining.

The search for a satisfactory solution of the problem continued, and Naval Constructor Robert Stocker at the navy yard, Norfolk, Va., obtained satisfactory results. Mr. Stocker believed that lead-lined pipe would give satisfaction, but it must be a *continuous* lead lining in intimate contact with the surrounding pipe and with no opportunity for the salt water to get between the lead and the outside casing.

Mr. Stocker's solution of this problem, which has so long given trouble, is as follows:

(1) The use of steel tubing for the outside covering, galvanized to increase life against external corrosion, with all flanged joints, and lined with a continuous coating of light lead forced into intimate contact with the tubing. The detail methods for accomplishing the results desired were devised under Mr. Stocker's directions, and these methods are in general followed today, although naturally there have been some improvements. Some of the improvements, notably the machine for pulling the lead lining into the tubing, have been devised at the Mare Island navy yard. Reference to these improvements will be made later.

Mr. Stocker had but one doubt regarding the success of the lead-lined pipe that he proposed. He feared that possibly with the varying temperature of the water, there would be a tendency for the lead to crawl and fatigue itself and break in a short time. To settle the question he experimented with a section of lead-

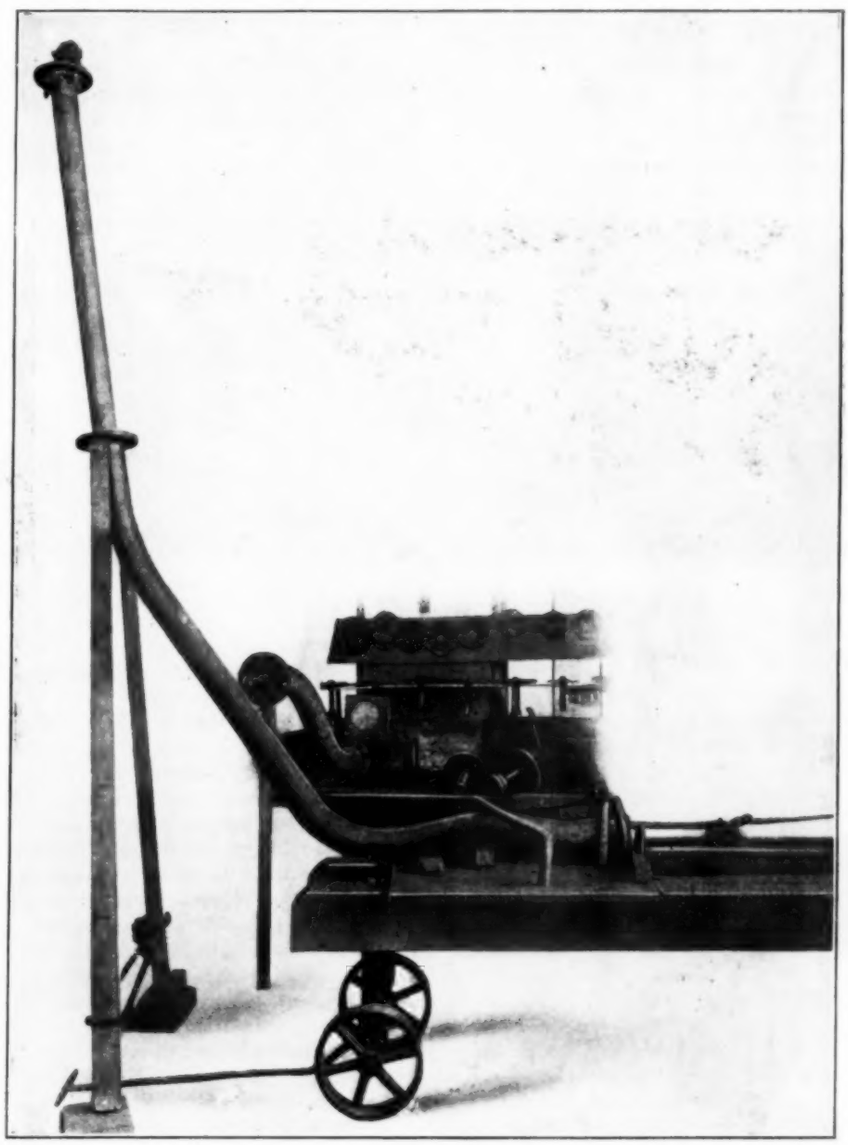


FIG. 4. LEAD LINING BEING DRAWN THROUGH PIECE OF PIPE WITH A NUMBER OF BENDS

lined pipe by passing through the pipe alternately steam and cold water. The pipe was flanged at one end and neatly sawed off at the other so that any movement of the lead would be instantly noted. There was no crawling of the lead during the experiment, showing that the contact between the tube and the lead was so intimate that crawling was prevented. No difficulty from this cause has been experienced with the pipe in service.

While sufficient time has not elapsed to determine the life of lead-lined pipe, it is certain that it is far superior to any piping previously used.

Methods Followed in Lining Steel Tubing

With the following description and the illustrations of the principal operations, it is believed that the methods of inserting the lining will be understood.

All joints in a line of piping are flanged. The flanges are recessed, to receive the lead, to a depth slightly less than the thickness of the lead lining, and the width of the recess or counterbore is about ¾ inch, depending on the size of the flange and the location of the bolt holes. The tubing is expanded into the flanges on an expanding machine and the edge of the flange and the tubing over which the lead lining will be worked is carefully rounded so as not to cut the lead.

The sections of piping with flanges fitted are galvanized by the hot process, Any roughness, caused by galvanizing, is removed; this is accomplished by drawing chain back and forth through the pipe and by smoothing off the flanged ends with a rough file. The inside of the pipe can readily be examined by means of small electric light and roughness detected. The flanges, particularly the rounded edge, should be carefully smoothed up so that the lead when worked over the flange will not be cut.

The lead tubing has an outside diameter of ¼ inch to ⅜ inch less than the inside diameter of the steel tubing.

A 4-inch manila rope, with one end fitted to a wooden plug, is rove through the lead tubing until the plug brings up in the end of the tubing, the joint being made sand tight by means of a little waste around the plug. The lead tubing is then filled with dry sand and the open end of the lead tubing worked down on the rope. The tubing is then well covered with tallow and entered in the steel tubing, the rope being rove through the steel tubing. The end of the rope is taken to the pulling machine (described later) and the lead drawn through, the outer tube being gently tapped with a wooden mallet. When bad bends are encountered it is considered desirable to warm the bend by means of a gasolene torch.

Fig. 5. Piece of Pipe Lined with Lead and Cut at a Bend for Inspection

When the inner tube has been pulled through, the end dressed down on the rope is sawed off, leaving the lead tube long enough to work into the recess on the flange. The wooden plug attached to the rope is removed and the sand run out. The lead on the end which has been cut is worked into the recess on the flange, and a flange provided with a connection for the hydraulic main is fitted. The pipe is then taken to the testing bench and connected with the hydraulic main. The other end of the lead lining is cut off about six inches longer than the pipe to be lined, and the plug detailed in Fig. 1 is fitted as there shown and in Fig. 2. The cock on the plug is opened to allow the escape of air and the water from the main is turned on, and when the air is out the plug is closed. As the pressure begins to rise the lead is forced toward the outer piping, and the air between the lead and outer casing escaping at the open end. As the lead is forced out the free end of the lead tubing is drawn in and it is on account of this that the lead tubing is cut off long. When this has been accomplished, the pressure rises and the lip on the plug shown in Fig. 1 is forced out against the walls of the piping and makes a high pressure, watertight joint. The pressure is run up to 300 pounds and then cut off.

If the lead should be broken or cut in being forced out, water will escape between the lead and outer tubing. In this case the break must be burned or if this cannot be accomplished, the lining must be removed. If care is taken in removing rough spots and the pressure is applied gradually, giving the air opportunity to escape and the lead to slowly expand, breaks are extremely rare. The flange with the plug is now removed, the lead cut to proper length and worked over the flange. A blank flange is fitted and a final pressure of 600 pounds is applied.

Machine for Drawing Lead Lining Through the Steel Tubing

When this work was first taken up, the lead lining was drawn through by a block and tackle. This method was crude, slow and expensive. J. T. Murphy, the assistant foreman in direct charge of this class of work, designed a machine for this purpose. The machine is shown in Figs. 3 and 4 and its operation can be readily understood. The machine is connected to the city water pressure, which varies from 15 pounds to 50 pounds, and also to the 100-pound pneumatic main. Ordinarily the machine is operated by water pressure, but when this does not give sufficient power, and on simple work when the lead can be drawn through rapidly without danger of rupture and quick action is desired, the air pressure is employed. The machine has been in operation for some time and has given excellent results, the lead being drawn through the outer tubing, even where difficult bends exist, quickly, surely and

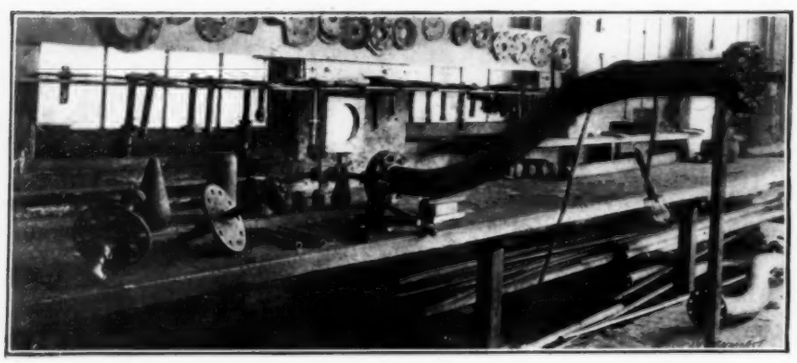


Fig. 6. Final Pressure of 600,000 Pounds Applied

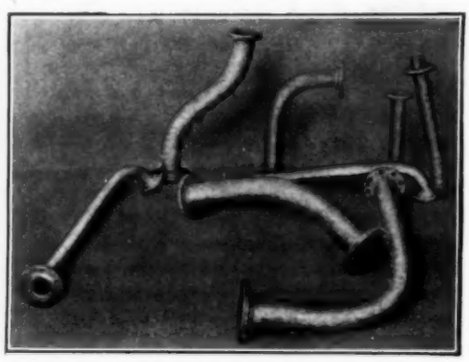


Fig. 7. Difficult Bends Successfully Lined with Lead

at small cost. Figs. 5 to 7 inclusive show the intimate contact of lining and tube and several difficult bends that have been successfully lined.

Lead Lining Used

To save weight the lining should be no thicker than absolutely necessary. It has been found that a thickness of about 0.1 inch is satisfactory. The sizes of lead tubing used and the weight per foot are as follows in the table.

Some difficulty was at first experienced in getting lead tubing of the right size and thickness, as there had been no commercial demand in the past for these sizes. This has, however, been overcome and a number of makers can now supply the tubing. There is also difficulty in shipping tubing of this light thickness. At first it was shipped in boxes packed in sawdust, but the piping was greatly

Outside Diameter. Inches.	Pounds per Foot. (About)
1½	2¼
1¾	2½
2	3
2¼	3¼
2½	3¾
2¾	4
3	4½
3¼	5
3½	5¼
3¾	5¾
4	6
4¼	6½
4½	7¼
5½	8½

damaged in transit, and now each piece is shipped on a wooden mandrel, two pieces in a box. The makers allow the mandrels and boxes to be returned, giving a rebate for the return.

Repairs to Old Piping

At present there is a large amount of copper salt water piping in ships, and in making repairs a great deal of this piping can be saved by lead lining. In a line which is giving trouble some sections will be found which are in such bad condition that they will not hold the pressure; these are condemned and steel tubing, lead lined, fitted. Many sections, however, can be utilized. These are cleaned, the pits closed by solder, wiped off smooth, the flanges counterbored and rounded with a special tool in the expanding machine and the lining fitted as in new piping.

Comparison of Cost and Weight of Copper Piping and Lead-lined Steel Tubing

A comparison of the cost of copper piping as previously fitted and lead-lined steel tubing shows that the cost of the latter is less than one-third of the copper pipe. The weight of the steel tubing, lead lined, is slightly less than the copper piping formerly fitted.

Qualities of a Good Foreman

By Entropy

We all recognize the desirability of having good foremen but we are seldom able to define what we mean by a "good" foreman, except by describing one that we know. As there are about as many types of good foremen as there are types of men, this does not help the man who is trying to find one. The safest thing to do is to go and hire a good man away from someone else. Yet even this has been known to fail and a good foreman in one shop has turned out to be a poor one somewhere else.

What, then, are the qualities that determine a man's abilities in this direction? Is it an intimate knowledge of what he is talking about? No! The best man I ever struck always had men under him who could do jobs that he could not touch with a ten-foot pole and they knew it. He knew in a general way whether their work was well done by the way the machine ran when it was put together, but he could not correct them in detail. They worked faithfully for him and got out the work and lots of it.

It is not enough, or rather it is sometimes too much for a man to be an expert workman at a particular job. The expert wants everyone to do everything just as he does it; he has no patience with a man who is a little slow or a little awkward. An expert too often means a putterer, and a puttering foreman is an expensive luxury.

The ideal foreman, as I have seen him occasionally, is a man with a large knowledge of men; a man who knows when a word of praise is worth a dollar and when it produces a swelled head. The ideal foreman must have some of the best qualities of a good salesman, and yet they will not always interchange. Both must create confidence, but one deals with well fed, well dressed men and the other with men in their overalls; and there is a difference. To inspire the confidence of the man in the overalls he must know what he wants and to keep his confidence he must want the same thing every time that he says he does, therefore we have another virtue—consistency as a prime essential.

Tact, yes, tact is a great thing. It may be tactful at times to tell a man to "get the h—— out of here," but not often. The good foreman knows when that will produce the desired result, and he has the nerve to do it when it will have the best effect on the rest of his force. Tact allows a man to do a job in a poor way when it finds that the man will be sore if he is compelled to do it the best way, and yet it may also set another man, who will do it the best way, alongside to set the pace.

The satisfactory foreman also holds his own with his employer with a firm hand. A foreman's position is a hard one because he must please and be just to those who are above as well as below. If he is to be just he will stop many an order as it comes from the office before it gets to the shop. The man who really is fair minded can do it and keep his job. The man who plays favorites cannot, because his employer has an advantage that he will be sure to use. The ideal foreman will insist that his recommendation as to wages be followed—and he will not make recommendations that ought not to be followed. He will insist on tools and jigs that he needs and he will know that they will prove profitable before they are asked for. He will stand as the spokesman for the men as much as he does for the employer, provided they ask for what they ought. Absolute fair play to all is the most difficult thing to find, and is likewise the largest essential of a good foreman.

A 'Sposin' Club

The usual noon-hour collection of machinists was gathered around a nail keg and a greasy pack of cards when someone remarked: "Supposing a man got cut bad, mighty bad on the arm or leg and the bleeding couldn't be stopped by cording the leg or arm, what is a fellow to do?"

As might be expected, the answers were as various as the individualities present but none of the answers seemed to suit, and it was left to a young machinist, who was acquainted with a surgeon, to get definite information upon the point in question.

In due time, when the young man reported, he said: "The medicine man told me that if I ever saw a cut where the bleeding couldn't be stopped, to put my finger right into the cut and shut off the artery. And if one finger wouldn't do it, to put in two fingers, or three, or if necessary, my whole hand."

The lesson thus received was put to good use a little later when a man was badly cut inside the thigh, and the bleeding was held in check in that manner, until a surgeon could reach the shop. The "boys" were so deeply impressed by the incident and by the manner in which the information happened to be at hand when needed, that they organized a "Supposing Club" for the noon hour, and it became so popular that the card-playing was usually forgotten.

Cam Shaft Milling in the Lathe

By H. M. York

A method of machining cams on their shafts by means of special holding fixtures and a milling attachment used in the engine lathe.

An arrangement of English design employing a pair of master cams, a cutter head, guide roll with suitable adjustment and other necessary features for accomplishing satisfactory results.

A readily applied and removable device which permits the lathe to be utilized for other work when not required for cutting cams.

Recently I designed an attachment for a lathe to cut cams, these being integral with the shaft. Fig. 1 shows this cam shaft which is of a good case-hardening steel. Each cam takes twelve minutes to cut and the time expended on the complete shaft, including setting, is one hour.

Our reason for choosing a lathe to do the work in, was, that our horizontal millers have plenty of work to do and the lathe could be better spared for the work. It is an 8-inch center hollow-spindle lathe; two days of the week it is operating on cam milling and the remaining days doing the ordinary work which goes to a lathe; thus we save the floor space that a special machine would occupy which would be idle the greater part of the week. To set up the lathe to cut the cams takes 15 minutes.

The Headstock Attachments

Fig. 2 is a general view of the apparatus and its success can be judged from the time we get out of it.

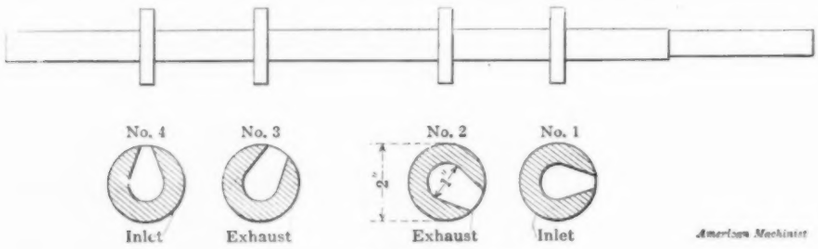


Fig. 1. The Cam Shaft

Fig. 3 shows the necessary additions to the headstock. It is not necessary to remove any of these when it is required to do turning.

The large wheel *B* at the back was bored out large enough to fit the sleeve *C*, which slides on the socket so that wheel *B* can be disengaged from its pinion. On the sleeve is a worm wheel of 30 teeth which also slides on its bearing to which it is keyed, and positioned by a set screw.

It is necessary for this to slide so that when wheel *B* is in gear with its pinion, the worm wheel can be pushed along until it is against the box of wheel *B*, then it is in such a position that when the lathe is being used for turning no obstacle is in the way of the driving belt.

A bracket bolted to the back of the bed, carries the worm to gear with worm wheel *D*; this worm is driven by another worm and wheel *E* and *F* which are also carried on the same bracket. Worm *E* is driven by a pulley on the end of its shaft, this pulley being driven from the large step of the driving cone.

The main driving belt is on the lowest step of the cone pulley. With the countershaft making 240 revolutions per minute we get one sixth of a revolution of the spindle per minute, thus it takes 6 minutes for a complete revolution of the spindle. The cams are finished in two cuts, taking a cut of ¼ inch deep each time.

Driving the Work and Cutter

A three-jaw universal chuck is mounted on the spindle used for driving the shaft. This must be of a very strong design or there will be trouble owing to the cam shaft slipping. The master cam plates are mounted on the back of the chuck and are set in such a position that the cam shaft can be properly indexed.

Fig. 4 shows the apparatus fitted to the saddle for driving the cutter. The gearing is contained in a box so that it may run in oil and is driven by the pulley shown, from a pulley on the countershaft.

Slide *A* carries the hardened-steel roller which is actuated by the master cams. The slide is adjustable, that is, it may be moved so that the roller can be engaged with either master cam. The

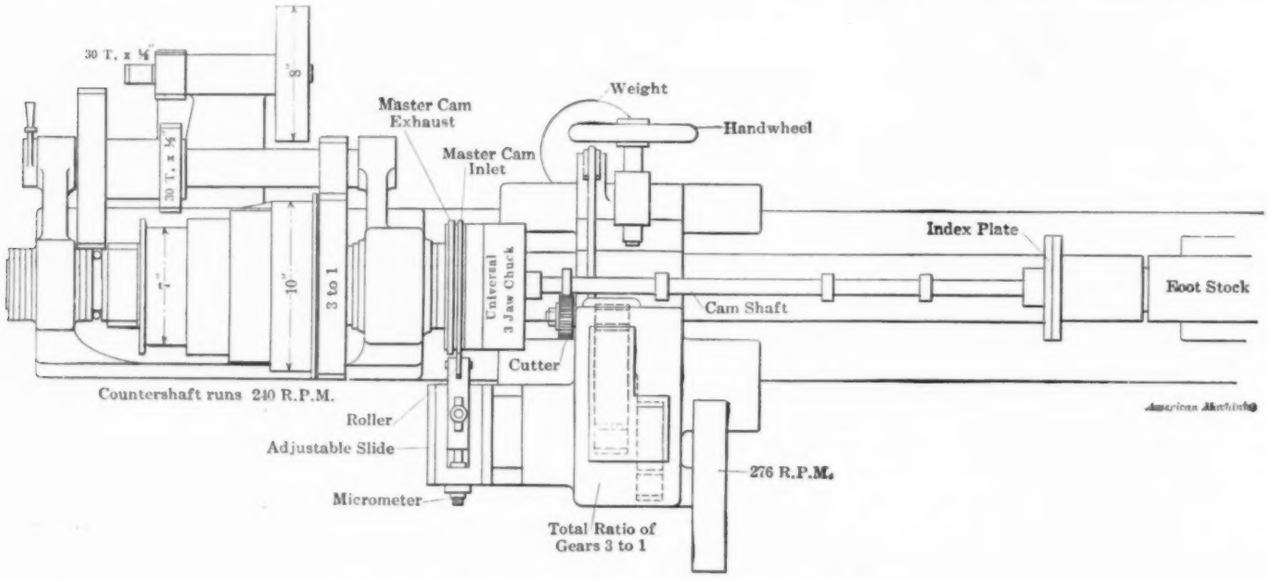


Fig. 2. Plan of Lathe with Cam-milling Attachment

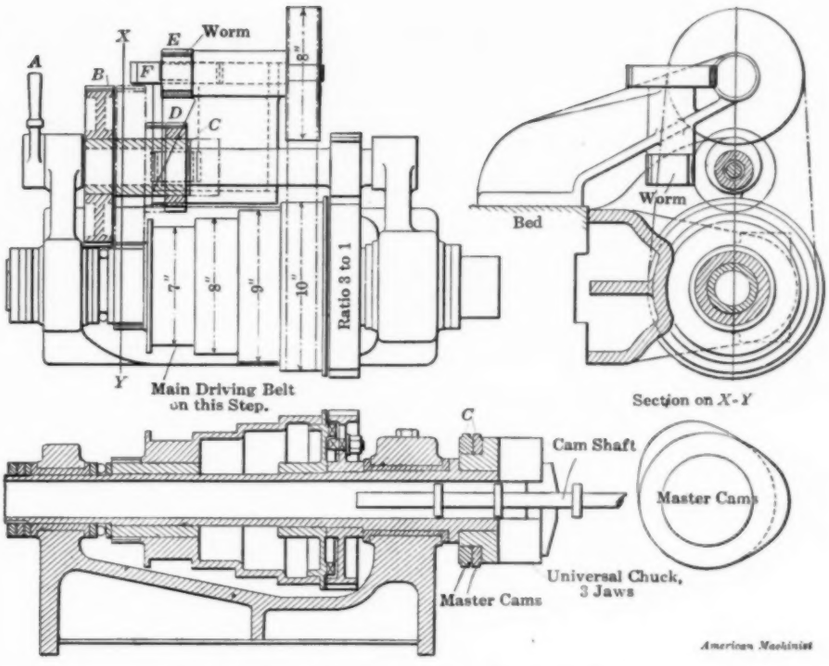


FIG. 3. THE HEADSTOCK ATTACHMENTS

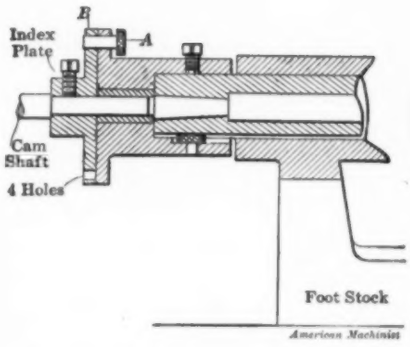


FIG. 5. INDEX PLATE AND OUTER SUPPORT FOR CAM SHAFT

roller has a micrometer adjustment which reads to one thousandth, the screw having 40 threads per inch and the micrometer plate 25 divisions. The adjustment is necessary to allow for the wear of the cutter. The weight *B* keeps the roller continuously engaged with the master cam when taking the last cut and the handwheel *C* is for setting for depth of the first cut.

CAM-SHAFT SUPPORT AND INDEX

Fig. 5 shows the arrangement for carrying the cam shaft in the footstock and also the method of indexing.

The index plate *B* is secured to the shaft by a set screw and its axial relation with the cam shaft is not disturbed until the whole series of cams are cut. The cam shaft projects through the index plate has four equally spaced holes, the dividing being done by means of end and uses this as a bearing. The index plate, fits in the bush on the spindle pin *A*.

When using the attachment it is much handier for the operator to stand at the back of the lathe; he then has an uninterrupted view of the work and is well out of the way of the driving belt on the saddle.

ORDER OF OPERATIONS

The cam shaft is passed through the hole in the spindle and the cam nearest the footstock is operated on first. The procedure is then as follows: Tighten up the chuck and see that the roller is engaged with the correct master cam. Now put the index pin in the plate and when the apex of the master cam is pointing toward the roller secure the index plate to the cam shaft and then remove the pin.

Revolve the handwheel on the saddle so that the roller just touches its master cam and then give it a complete revolution to the left. As the pitch of the thread is quarter inch and the thread right hand the cutter will be able to take a cut ¼ inch deep before the end of the screw arrests the cross movement of the cutter head.

Set the lathe in motion and when the spindle has made one revolution, which brings the apex of the master cam again toward the roller, give the handwheel three turns in the same direction as before; now the roller will engage with the master cam all the way round and the cutter will finish the cam.

CUTTING THE NEXT CAM

Stop the lathe when the one revolution is completed, unlock the chuck and move the cam shaft so as to operate on the next cam, which must be at the correct angle to the previous cam cut. The pinion on the back shaft is thrown out of gear with the front wheel by means of the eccentric, then the lathe spindle can be revolved by hand and as the position of the index plate on the cam shaft has not been disturbed it is an easy matter to get the correct position of the next cam.

When the cam shaft is again set, follow out the previous instructions for cutting, again index, etc., until the rest of the cams are cut.

If possible, one belt lever only must be operated for moving the belts on the shaft and a good supply of lubricant must be used for the cutter.

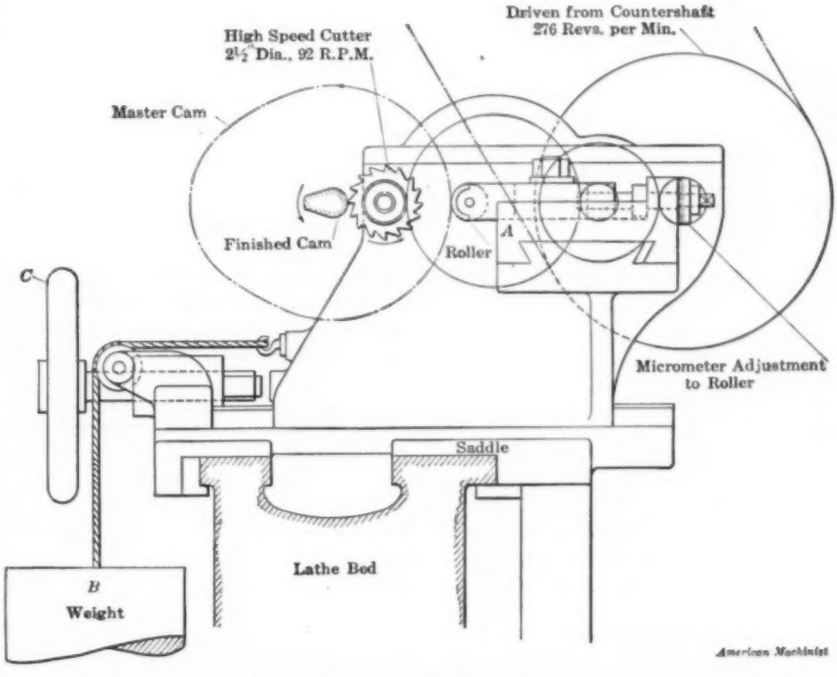


FIG. 4. CUTTER SLIDE AND SADDLE

The Figures Behind the Aeroplane

By Warren H. Miller

Enumeration of laws of planes moving in air, proportions of increase in size and tabulated data of existing successful machines.

The apparatus for testing the physical laws which lie back of the designs of heavier-than-air machines, is so simple and exact that any person in possession of ordinary machine-shop facilities can construct such a testing equipment. Fig. 1 shows the essentials of a primitive testing machine, and yet one sufficiently accurate to base real calculations upon. You need a heavy base, containing a long vertical bearing, in which turns a spindle, which carries at its upper end an arm having a universal clamp at its outer end, by which arm the plane to be tested can be set at any angle. The spindle should be provided with a drum to carry the cord which gives it rotation, a platform on which weights can be put to measure lifting power, and a step-bearing at its lower end, under which is a spring which can be adjusted to exactly balance the weight of the spindle, drum and plane. The apparatus is actuated by falling weights, with cords wound around the drum. By using the two weights, side pull is eliminated, so there is virtually no friction loss to be allowed for and the work expended on the plane will be exactly the weight, multiplied by the distance it falls in a measured time. Knowing accurately the length from the center of the spindle to the center of the universal clamp, one can, by means of a revolution counter, get exactly the speed of travel of the plane. Its resistance to the air is in direct proportion with the weight, the couples of the plane arm and the radius of the drum, and its lifting effort is obtained by putting weights in the platform on the spindle until it refuses to rise.

A simple enough apparatus; yet by its means, all the laws of the resistance of planes can be verified, tests made with small models, and various sizes and shapes of planes can be tested with the same weight to get their relative efficiencies. It may be mentioned in passing that there is plenty of room for improvement in this direction alone, as our very best 'planes have only one-half the lifting power in proportion to their area as compared to the wing of a bird.

The Laws of Planes Moving in Air

There are four fundamental principles which can be worked out with this apparatus:

1. With the plane normal to the direction of rotation, the horsepower expended increases as the area of the plane.
2. With the plane normal to the direction of rotation, the horsepower increases as the square of the speed of movement of the plane.
3. The horsepower increases in simple proportion to the density of the air.
4. With plane oblique to the direction of rotation, the horsepower will be the resultant of two forces, of which one is directly measured by the weights lifted in the platform on the spindle, and the other can be calculated by the parallelogram of forces thus obtained.

Further experiments with various shapes of planes will bring out the fact that a long, thin plane of about 10 to 3 proportion of length to breadth with the long dimension presented to the wind, will lift a good deal more, in proportion to the power expended upon it, than any plane where the area is nearly square or the small dimension is presented to the wind instead of the long dimension. The reason of this is as explained in a previous article, that the whole process of aviation consists, first in making an artificial wind by moving the plane through the air instead of holding the plane still and letting the wind blow upon it; and secondly, in taking the kinetic energy thus obtainable in every particle of air the plane comes in contact with, and utilizing it as static energy in supporting the plane. Therefore, as each particle is struck by the plane, its *relative* speed and relative energy, so to speak, is at once utilized, and it becomes dead to the plane, having virtually the same speed as it has, and the sooner it is passed out astern and gotten rid of the better. The plane is thus constantly using new particles of air, but if it is a long rectangular thing, with the short dimension running into the wind, each particle must roll along the plane inert, after once being used, and so all the rear part of the plane is of little use.

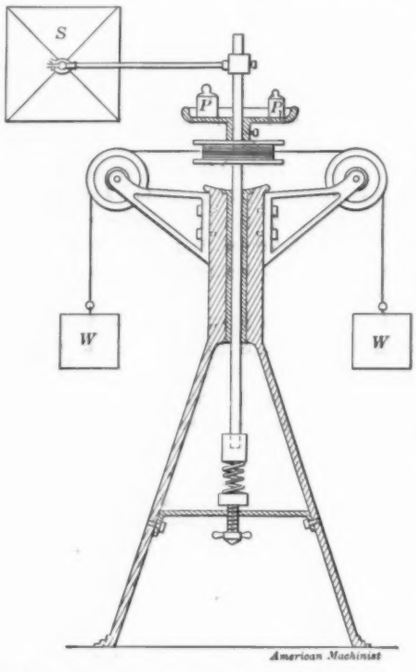


Fig. 1. Machine for Testing Planes

Another empirical discovery that can be verified with this apparatus is that a curved hollow plane will lift a good deal more than a flat one, and will do it best if the curve is the arc of a circle in which the crown is 1/12 of the cord. The reason seems to be that many of the particles of air get away without doing any work at all on the plane, if it is flat, but, if slightly concave, even particles that do not actually touch the plane at all, give up their energy by transmission through the intervening layers of air. Another curious fact that comes out is that the center of pressure does not remain at the geometrical center of the plane, as it is inclined to the wind, but comes forward, due, probably, to this same molecular action of the particles of air.

The next step would doubtless be the construction and test of the performance of a small model. Combining the above principles with those of elementary mechanics, we get the following laws for increasing the dimensions of the little model to a large size. It may be well to state that for immunity from errors in proportion it is well to have the small model of not much less than eight feet spread of wings.

Laws of Increasing Proportions

1. The tractive effort, being directly proportional to the weight to be raised, will increase as the cube of the increase in linear dimensions.

This follows from the fact that almost everything which is increased proportionally in all three directions will gain weight as the cube of the increase.

2. The speed of the little model, multiplied by the square root of the proportion of increase, will give the speed of the large machine.
3. The power of the motor will increase in the ratio of the cube of the figure of increase, multiplied by the square root of that figure.

This law follows from 1 and 2, for the horsepower is the tractive effort into the speed. As the tractive effort increases directly as the weight, or as the cube

of the linear proportion of increase, and as the speed increases as the square root of the proportion of amplification, the horsepower will increase as both of these together, hence the rule 3.

4. The revolutions of the enlarged screw will be the reciprocal of the square root of the figure of increase multiplied by the revolutions per minute of the small screw.

This last rule is, like the one on the speed of the machines, derived from similar laws worked out for marine proportions of models and full sized craft, the calculations for which cannot be given here.

Considerable judgment must be exercised in using these formulas, or they will lead one to utterly ridiculous conclusions. For instance, Rule 1 assumes that the weight of the enlarged model will increase as the cube of the linear dimensions. So it would if it were a block of oak, but you know very well that you can design an aëroplane of twice the linear dimensions that will weigh, not eight times as much, but hardly three times as much as the smaller model, by judicious selection and disposal of materials. As the horsepower of Rule 3 depends to a great extent on this matter of the weight, it must be watched carefully. For instance, a plane with length of 44 ft. tip-to-tip of wing, portative surface of 345 square feet, and weight of 600 pounds, will take 18.8 horsepower to drive it theoretically, or a 40-horsepower motor in actual practice. Suppose we wish to know what would be the corresponding weight and horsepower of a plane of one-half the linear dimensions, or say, 20 feet spread of wings. The proportion of increase will then be 2, the cube of which is 8. Therefore, the weight of a plane 20 feet spread will be ⅛ of 600, or 75 pounds! Yet the actual weight of the *Demoiselle II* is 220 pounds without her passenger; with a spread of wings exactly 18 feet. Trying out the horsepower by the Rule 3, you divide 18.8 by the cube of 2 and then by the square root of 2. It will give you just 1.66 horsepower, and yet the *Demoiselle II* takes a 25-horsepower motor to run her! The reasons for these apparent discrepancies lie entirely in the design. Barring the motor, a small plane exactly similar to the large one *can* be built that will weigh only 75 pounds and of course, it carries no passenger. The horsepower will then drop down to 1.66 theoretical, without any trouble, and you can believe it.

Therefore, in experimenting with a little model of, say, only five to ten feet spread of wings, you can get accurately with the testing machine what it will lift and the horsepower it will take. The amount a larger plane will lift, at the same speed, will increase directly as the area of the plane, but the total dead weight is another matter. It will not increase as the cube, so about the first thing to do is to design the large wings and frame and calculate their weights from known data of the materials. To do this you must know the effort exerted by a square foot of the plane at that speed. To get maximum effect, assume the plane moving perpendicularly to the wind, multiply the surface in square feet by the density of the air, then by the square of the speed in feet per second and then by an experimental coëfficient. This latter has been worked over by all the scientists since Poncelet, and a fair mean figure, already multiplied by the density of the air (1.293), is 0.001406, so this has only to be multiplied by the surface and square of the speed to get a result in pounds. Here it will be necessary to use judgment again and check with an assumed probable dead weight of the large aëroplane. The angle of incidence of most planes in practice varies from 2 to 7 degrees, so that 15 degrees would give one ample leeway for reserve strength in calculation of the actual strains per square foot of plane that will come into play. The sine of this angle, of course, gives the strain when multiplied by the figure obtained for a perpendicular plane.

Where the Possibilities Lie

It is often advanced by prophets on the future of the aëroplane that they cannot reach any commercial importance because of Rule 3, wherein the motor grows much faster than the cube of the linear increase, being also multiplied by the square root of that figure. But, as this whole calculation of the horsepower of the motor varies as the cube of the total dead weight, it is easy to see that by reducing this as much as possible the horsepower will not grow with such tremendous increases. In the motor's own weight, this *decreases* with the increase of horsepower, so that even with 50-horsepower sizes, it is now down to 2 pounds per horsepower, and with larger motors of bigger cylinder area, it should further decrease. There is plenty of room for improvement in the possibilities we now have right to hand, and, as an incentive, we have Rule 3, which promises a gain in useful horsepower for every pound of weight saved, in the ratio of the cube of the figure of change. At present, aviation is the most wasteful of all the ways of transporting substances. American freight trains move a ton of dead weight horizontally on about five pounds tractive effort; cargo steamers do the same on about two pounds; express trains, twenty pounds per ton; automobiles, 45 pounds, and aëroplanes, 225 pounds! Not only that, but they are limited by the winds from going out at all and limited by structural considerations from being built any larger than a given best size for any one design.

When we see what has been accomplished by the "Sirocco" type of fans in making the most of many planes with long flat vanes, giving maximum efficiency in imparting kinetic energy to particles of air, it is easy to hope for like improvements in aëroplanes along the lines of multiplane effort, where so much material will not have to be expended in holding long flat planes rigid.

Motors Are Light Now

In the motor itself, the need is not very pressing at present for anything much lighter than two pounds per horsepower. The classic aëroplane accident, that every new designer runs up against, is invariably too large a motor for his plane. In the general hope of getting the thing plenty big enough, he cuts loose from any calculations, and puts on just as big a motor as the plane will lift. This is about as dangerous a proceeding as can be devised, for in the air there is no means of wasting excess horsepower, except by using it to lift the plane vertically. In a boat, the resistances grow so rapidly that no matter how much too large the motor is, the boat soon reaches a limit of speed. But if you have very much more lifting power than you really need in an aëroplane, you have only two courses to elect. Either tilt the plane so as to use it in rising upward, and keep on doing it, until you are far too high for comfort, or else set your plane as close as possible to the horizontal. This last position is very perilous, as the least waver will let the air in on top of the plane, and the unfortunate pilot will be dashed to the ground with such a force and suddenness that there is little hope of escape. Any motor that requires one to hold the plane much closer than 3 to 5 degrees to the horizontal, is too dangerous even for experimenting with. It therefore behooves one to keep pretty close to Rule 3, using the calculated dead weight, instead of that obtained by cubing the weight of the small model, and thus getting a motor size that will be somewhere in line with actual results.

This does not mean that the motor must be calculated strictly, and have no reserve to meet all sorts of gusts of wind and other derangements met with in flight. It should be able to drive the aëroplane so as to maintain equilibrium with the main plane set at a fair angle to the horizontal, for one cannot vary the speed of the motor to all sorts of revolutions, as in a motor boat. This angle of incidence and the mean speed of the motor constitute the floating power, so to speak, of the plane, and changes in level and speed of flight are managed by the stability planes, or *equilibrieurs* as the French call them. You can readily see that these little planes, set forward of the main plane, as in the Wright and Farman machines, and at the rear, as in the Blériots and Antoinettes, exert

Make.	Type.	Weight, Lb.	Spread, Ft.	Width, Ft.	Surface, Sq.Ft.	Angle of Attack.	Length, Ft.	Speed, M.P.H.	Motor, H.P.	Make.	Screw, Diam.	Screw, Pitch.	Screw, R.P.M.	Screw, Tract. Eff't.	Rear Plane, Sq.Ft.	Rudder, Sq.Ft.	Fow'd Stab. Plane.
Blériot XI.....	M.P.	750	28'3"	7'5"	150	7°	26'5"	44	25	Auxain	6'10"	2.0	1350	220 lb.	21.5	11	none
Blériot XII.....	M.P.	1050	32'0"	9'3"	292	7°	22'5"	48	60	E.N.V.	8'11"	..	580	165 lb.	.....	...	none
Antoinette V....	M.P.	1150	48'6"	10'0"	345	4°	37'9"	..	50	Antoinette	7'3"	4.27	1100	..	.....	...	none
Demoiselle II..	M.P.	230	18'0"	6'8"	120	..	19'6"	40	25	Clem. B'y'd.	..	..	1500	..	.....	...	none
Clement-Bayard.	M.P.	..	43'4"	8'3"	248	..	35'6"	40	50	Clem. B'y'd.	7'11"	8.2	1200	..	75	...	none
R.E.P. II.....	M.P.	930	31'4"	7'5"	170	..	25'8"	40	35	R.E.P.	6'6"	..	1500	..	.....	...	none
Farman.....	B.P.	1200	39'6"	5'4" ea.	430	3°	32'9"	40	60	Gnome	7'7"	4.6	1200	..	6'x9' ea.	5'x6'	3'x14'
Voisin.....	B.P.	1200	37'8"	6'0" ea.	540	2°	39'4"	40	50	Gnome	...	..	1200	..	6'x19' ea.	...	none
Clement-Bayard.	B.P.	..	38'0"	6'0" ea.	645	3°	37'10"	..	40	Clem. B'y'd.	8'3"	..	900	..	6'x8' ea.	...	3'x15'
Sommer.....	B.P.	670	32'8"	6'0" ea.	388	..	..	50	50	Gnome	..	..	1200	..	6'x8' ea.	...	..

DIMENSIONS OF FRENCH AEROPLANES.

a couple on the main planes about their horizontal axes. They can thus change the angle of incidence of the big planes and hold them at any angle desired. Now, if the motor is of the right size, the plane will travel along pretty nearly horizontally and at a mean speed. With the little planes the pilot holds the whole thing level, rises or falls gradually from one position to another and alters his speed within certain limits without touching the motor at all. If he tilts the plane a little above the mean, the speed of flight will instantly slow up and the plane gradually ascend; the reverse gives increase of speed and descent. This is with calm, still air. If there are strong winds, none of the currents will be traveling in horizontal lines and the pilot will be constantly tilting the stability planes to hold his own horizontal direction.

For continued rising or falling, such as landing on the earth and rising from it, one should be able to change the speed of the motor with carbureter and timer, as the stability planes will only operate at a given speed of the motor within narrow limits. Therefore, if you wish to ascend or descend rapidly, the motor speed will have to be altered, and therefore the ideal conditions will be a motor that will be of the right size to keep the plane steadily on her course, and yet have a reserve of several notches of the carbureter for sudden ascents. The descents will take care of themselves. It suffices to slow the carbureter one or two notches and shut off the motor altogether and glide to earth, when near the end of the descent.

Steering Surface Required

Another matter that must be looked to in aëroplane calculations is the relatively large size of the steering surfaces compared to what are efficient in marine surfaces. For a biplane of, say, 35x6 feet the forward stability plane should not be much less than 15 feet long by 3 feet wide; the rear stability planes about 8x6 feet each, and rudder about 5 feet long. The reason is that the mass of the air is very small, and to get good turning effect, ample surfaces must be provided. The same follows for the "feathering" or fixed horizontal vanes, which the French use on all their flyers to prevent bobbing and uneven flight. Practically all the available mechanical space on the Blériots, for instance, is utilized for this purpose. Further, in all the latest models, the frame or boat is covered with varnished canvas, not only making good longitudinal stability vanes but preventing a very noticeable friction loss from the wind dragging through the framework of the boat or queue, or tail, or whatever form the main frame takes. Above is a table of principal dimensions of a number of contemporaneous French aëroplanes.

Watch Out for Your Fingers

A few days ago a machinist staggered back from his lathe with the blood streaming from his left hand. After he had been hustled through the first-aid room and up the street to a surgeon, a fingernail, smooth and without a break, was picked up under the lathe and it was afterward found that the nail had been torn off the second finger of the left hand and that the finger had been crushed about ¾ of an inch from the end. The machinist was engaged in boring a 1.9-inch hole through an 8-inch cast-iron sheave and had chucked the work and was adjusting the tool post when the accident occurred.

This accident may serve as a lesson to the man not to monkey with the tool post of a lathe while the spindle is running, especially on faceplate work. As a safeguard against accident, both to tools and to workmen, a lathe should be stopped when a tool post has to be put into or removed from the slide rest. It is only a question of time when an accident will happen if the machinist persists in tool-post manipulation with the slide rest within a short distance of the revolving chuck-jaws. In this accident, the workman caught his finger between the corner of the slide rest and one of the chuck-jaws and the impact of the revolving jaw simply slipped the nail off the finger like the skin off a bit of onion.

There is another thing which some machinists persist in doing; the leaving of a chuck key in the chuck after removing work from the lathe. No matter whether or not the lathe is to be started again on a new piece of work within two minutes, don't *don't*, DON'T ever allow a chuck key to remain in a chuck after you have removed your hand from the key. It is all right as long as the hand is kept on the key, but once take the hand off, and there is danger of an accident. One can never tell when the lathe will start up with the key in the chuck. And when it does start, it is too much like cranking a back-firing automobile engine—far too much like it for comfort or safety of fingers or arm.

The usual cause of trouble from a key left in the chuck, is the starting of the lathe by the workman, the key having been forgotten. But sometimes the clutch sticks and the lathe starts for a few turns or even a part of a turn and the damage is done before the mechanic realizes what hit him. In addition to accident to the workman, the damage to the shop equipment may be considerable when a key is twisted out of a chuck by the starting of the lathe. The least that usually happens, is the breaking of the key, but it is very apt to injure the screw of the chuck to which the key chances to be attached, and occasionally it strains the entire chuck so badly that rebuilding is necessary to make the chuck run true again. This warning has often been sounded but is still often neglected.

Portable Railroad Shop Tools

Editorial Correspondence

A number of portable appliances that have been found useful in shops of the New York Central lines. They include Oil Furnaces, Portable Platforms, Flue Racks and Barrows for Hot and Cold Work.

A portable oil furnace for heating rivets or any other work which may require being done, is shown in Fig. 1. The whole thing is mounted on a three-wheel truck and provided with a handle so that the small third wheel can be easily lifted off the floor and the whole furnace wheeled into any desired position on the large 12-inch wheels.

The oil is carried in the tank below, while above is the furnace properly fire-bricked and provided with a suitable oil burner, which is operated by compressed air. The compressed air is taken from the shop line at any convenient point by the air connection shown so that it is unnecessary to carry a compressed tank on the machine itself. All necessary dimensions are given, so that anyone can build a furnace of this kind, should they desire to do so.

A very convenient portable platform for overhead work is shown in Fig. 2. In shops with high ceiling, which is the modern tendency, a platform of this kind will be found much more convenient and safer in every way than the use of tall step ladders. This has a substantial base and is mounted on a pair of 9-inch wheels and provided with handle, so that it can be easily moved from place to place. The working platform is 34x40 inches, which allows two men to work comfortably and is much more desirable in every way than the other method. Men

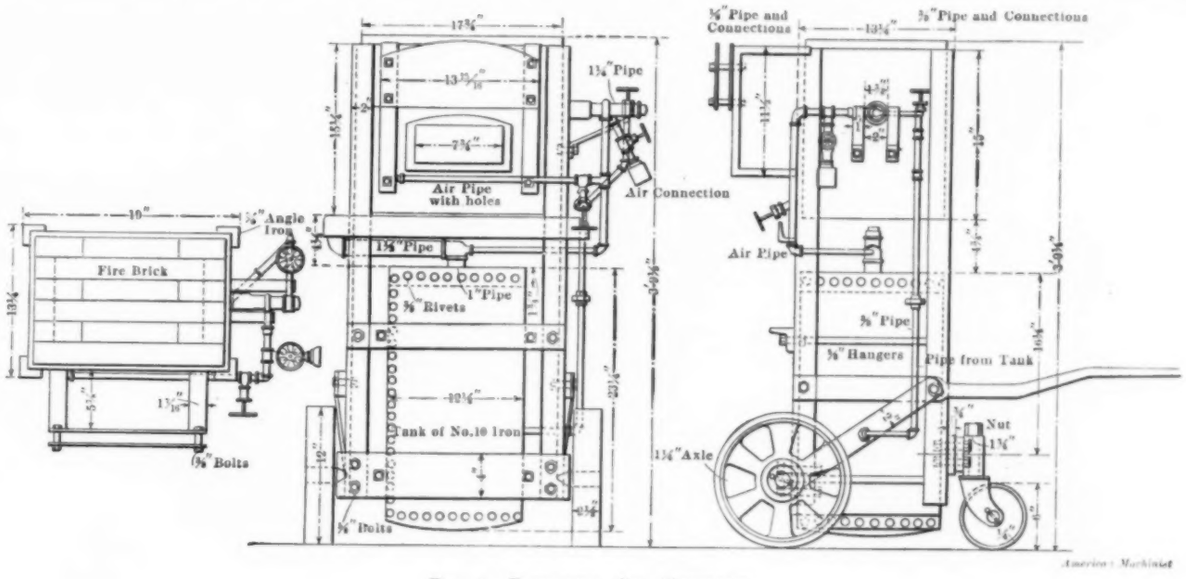


FIG. 1. PORTABLE OIL FURNACE

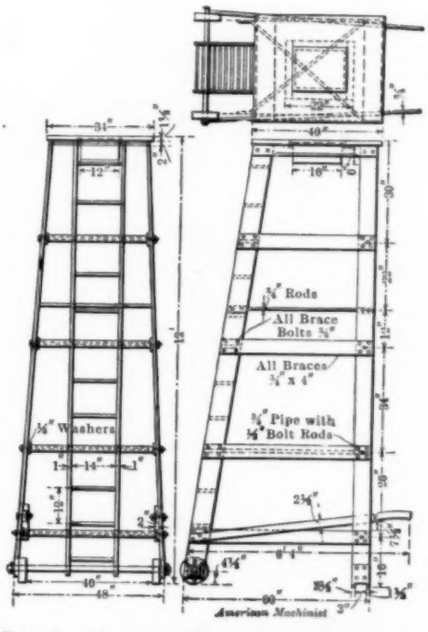


FIG. 2. PORTABLE PLATFORM FOR OVERHEAD WORK

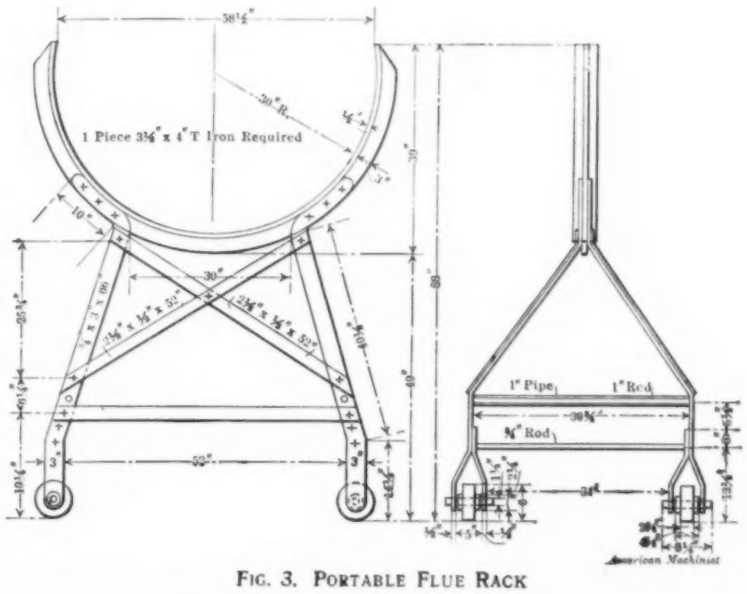


FIG. 3. PORTABLE FLUE RACK

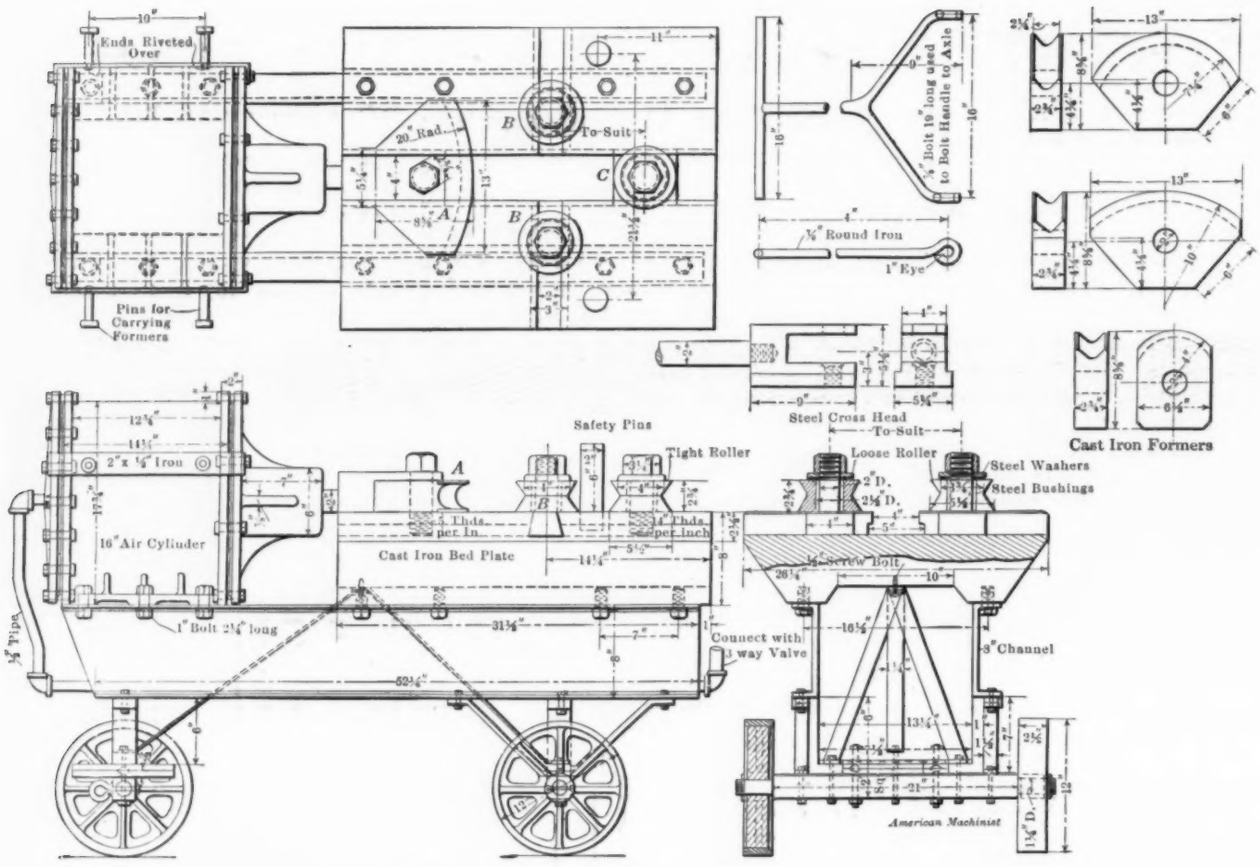


FIG. 4. PORTABLE PNEUMATIC PIPE BENDER

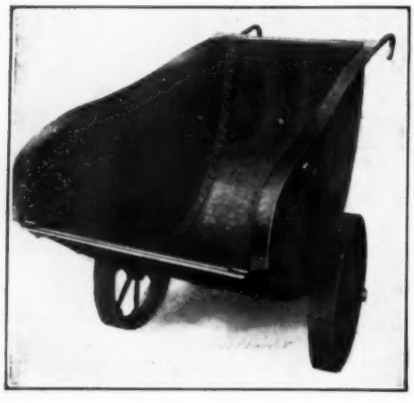


FIG. 5. BARROWS FOR HOT WORK

feel perfectly secure on a platform of this kind and can work without fear, which means that they will accomplish much more in a day. Platforms of this kind should do much to reduce accidents due to step ladders, and should prove a profitable investment. The dimensions are given solely as a suggestion and can be adapted to the needs of any particular shop.

Fig. 3 shows a portable flue rack which has been found very convenient, and which requires no explanation to show how a pair of these will be found greatly useful beside any flue welding or other machines which worked on flues. It has a large capacity, as can be seen from this size, and the legs are spread far enough apart to make it very rigid and will not be easily overturned.

Fig. 4 gives the details of a pneumatic pipe bender, which is mounted on a substantial truck with 12-inch wheels, so that it can be moved to any desired part of the shop. It consists of a 16-inch air cylinder, which forces the forming block *A* against the pipe, which is supported by the rollers *C B*. These rollers are adjustable crosswise in piece lap, and in combination with forming block *A* to having any desired radius, almost any shape may be bent. Another roll is provided at *C* for special work. The air supply is taken from any convenient point in the shop line, and the whole machine is found to be very useful in pipe-bending work. These devices are from the Beech Grove shops of the Big Four railroad.

In Figs. 5 and 6 are shown two steel barrows which are being used at the East Buffalo shops of the New York Central Line in both forging and bolt-cutting departments. Fig. 5 was designed especially for hot work and is used to hold the bolts as they come from the bolt-heading machine. This barrow is practically inclosed, so that the bolts may be thrown into it with the tongs direct from the bolt-heading machine and

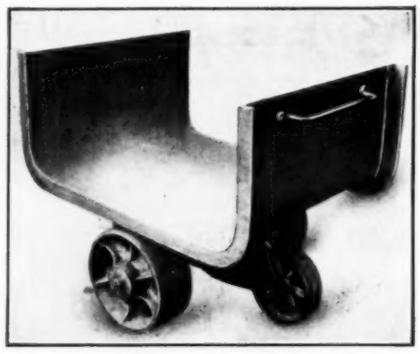


FIG. 6. BARROWS FOR COLD WORK

prevent any of the hot bolts going astray and injuring other workmen.

In Fig. 6 is a very convenient form of barrow for cold work. It is open at both ends and strengthened at each head by angle iron, the whole thing then being supported by a very substantial truck beneath. The bolts are piled in this for the thread-cutting operation and placed in a similar barrow after the thread has been cut. They allow the work to be handled very rapidly and save considerable time over the old method of throwing them on the floor, which requires their being picked up again and carried to the storehouse or to where they were to be used. Work-handling methods of this kind can be introduced into many places which are still going on in the old way.

Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print is good enough to pay for. The value is in the idea—not the length of the letter.

A Centering Device

The device shown in Figs. 1, 2 and 3 was designed and patented by George Brenneisen, and it is now in use at the shops of Barnhart & Davis, Warren, Penn.

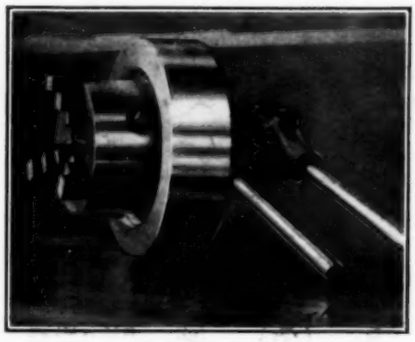


FIG. 1. THE CENTERING DEVICE

The general appearance of the device is well shown in Fig. 1. It will center round or hexagonal stock up to 4¼ inches diameter, and only weighs 23 pounds.

Fig. 2 shows the device in place on a round bar. It should be noted that there is no tailstock center or support used, the device being perfectly free to move with the shaft, no matter how much it runs out. The end here shown ran out about half an inch. The operation will be clearly seen by referring to Fig. 2, and the assembly sections of Fig. 3. One end of the piece to be centered is chucked, as usual; the other end runs free if the piece is short, or over a rest if it is long. This free end is then grasped by the jaws of the centering chuck. In Fig. 3, the center drill *A* can be seen, held in a split taper sleeve and the sleeve screwed into a sliding spindle at the outer end of which is the hand lever *B* for advancing the drill. This spindle slides through the hollow pinion *C*, which, with the drill, rotates counter clockwise when the lathe is started, being driven by the internal gear *D*, which is part of the chuck, and the intermediate pinion *E*, which is carried by the nonrotating hub.

After starting the lathe, the operator grasps the handle projecting from the hub in the left hand, and with the right hand on the drill lever, the center is drilled as deep as desired. After centering the opposite end in same manner, the shaft will be found to run absolutely true. A two-foot length of shafting can in this way be centered up perfectly in one and a half minutes, which is a vast saving over the usual method.

Where a large amount of centering is to be done, the device is suspended in a sling, so that no time or energy is lost in lifting it on and off, merely being required to swing it around and tighten the jaws.

It is very useful for centering engine cranks and other work of that character, and on very large heavy work it can be used by revolving the handle and hub around the work (which would lie on horses or held by crane), the drill is thus rotated and the center can be drilled.

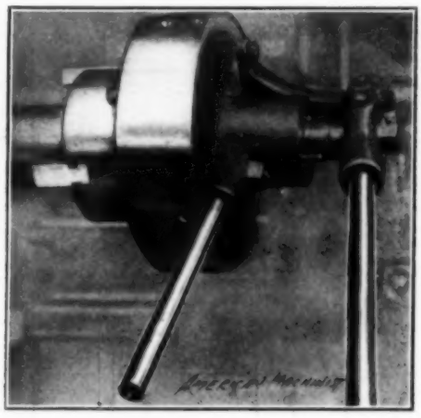
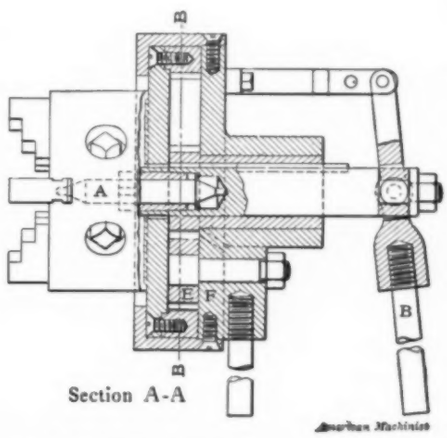


FIG. 2. THE DEVICE IN USE

Rochester, N. Y. RALPH W. DAVIS.

Section B-B



Section A-A

FIG. 3. DETAILS OF THE CENTERING DEVICE

Making Small Grinding Wheels

Many grinding-machine operators on accurate work make their own wheels for internal work out of pieces broken from external wheels that have been worn down too small for further service, as such wheels cut more freely in the smaller sizes than those that are bought. The difficulty is to find a satisfactory method of making the holes in the pieces. This is generally accomplished with the aid of an old file tang, or similar instrument.

After having tried several ways, I consider the following the most successful and the least troublesome: Take a piece of thin steel tubing of external diameter approximately the size of hole required, and with a three-square rough file of fair size, make three or four coarse teeth in the end of tubing after the manner of the teeth in a hollow mill, then chuck the tube in a drill press, and with a rather slow speed it will take a core clean out of the piece of abrasive in a second or two. The teeth in the tubing will need renewing after cutting through a few pieces; this can quickly be done with a few strokes of the file.

The outside of the intended wheel should be trimmed up fairly concentric with the hole on a roughing bob, or with an old rough file before using.

Coventry, Eng. J. A. PHILLIPS.

A Facing Attachment

It is often necessary to face off one end of pieces produced in automatic turret lathes, as the cutting-off tool does not often make a smooth finish. The appliance herein described may also be used for larger blanks, which have been turned and faced on one side in an engine lathe. To put these blanks on an expansion arbor takes time and is not always satisfactory. The use of the universal chuck has the same objection. The appliance mentioned consists simply of short studs held in the chuck or collet of the lathe, provided with a loose key which is set in the projecting end to carry the piece. This key is made slightly dovetailed, so that it will not fall out when the blank is removed, and has a rounded bottom so that it can fall forward and release the piece.

The accompanying sketches are practically self explanatory.

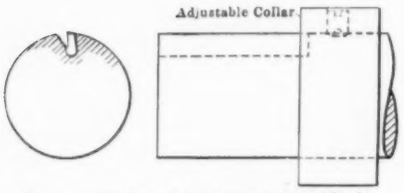


FIG. 1. Stud used for face end of blank.

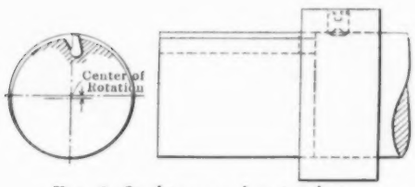


FIG. 2. Stud to use when turning diameter of blank *American Machinist*

A FACING ATTACHMENT

A collar may be placed on the stud to prevent the piece from going too far. The piece will slip on to this stud with perfect ease when the key is laid forward and is just as readily removed by first giving the piece a slight forward twist, which releases the key.

Of course, as the piece must necessarily be a sliding fit on the stud, and is drawn to one side by the key it will not run true on the outside. It cannot be used when the diameter of the piece is to be machined in this operation. If this is necessary, the stud may be made as shown in Fig. 2. The portion of the stud carrying the blank is made eccentric; the center of rotation being midway between the point of key and opposite side of the stud. By this arrangement the stud may be made as much under the size of blank as necessary.

New York, N. Y. C. H. LOGUE.

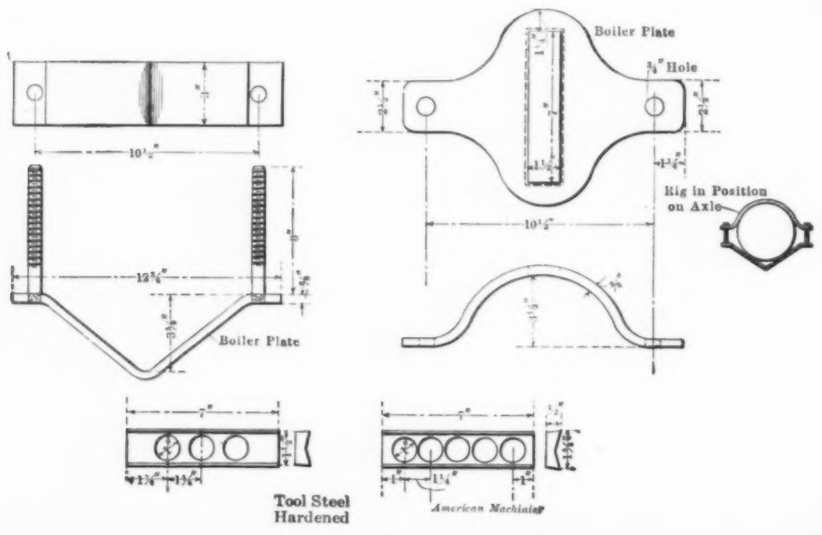
A Jig for Cutting Keyways in an Axle

We have not an uptodate keyway cutter for milling the keyways in the axle, so we have to do the next best thing, but we can do them almost as well and in a short time by our method.

After the keyways are marked on the axle we have a jig for guiding the drill. A clamp, as shown in the accompanying illustration, large enough to fit the largest axle, has a slot in the clamp to hold a tempered-steel die shown; one for short keyways and another for longer ones.

These are made a little taper so that the clamp will hold it solid, and the under side is hollowed enough to fit the smallest axle. With the jig clamped even with the lines over the keyway we drill a row of holes the proper depth, move the jig over and drill out what was left between the first holes. This leaves very little to cut out with a chisel and drift.

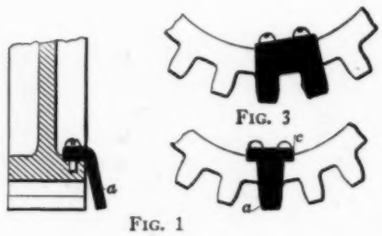
Clinton, Ia. CHARLES MARKEL.

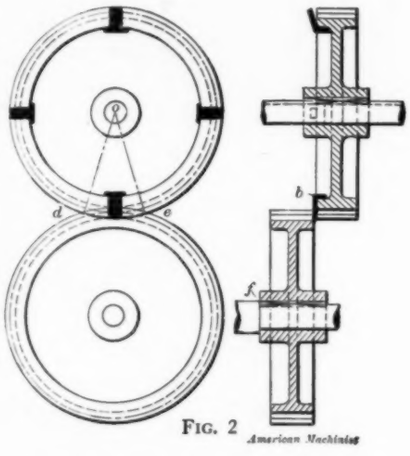


ECCENTRIC AXLE KEY-SLOT JIG

Spring Tooth for Sliding Gears

Sliding one spur wheel in and out of gear with another spur wheel, is very often made use of when altering the speeds of shafts; such as changing from a double-gear drive to a triple-gear drive in a large lathe headstock. The wheels in such a case are very often heavy, and require a great deal of time and energy in sliding them into gear. First you push the wheel to slide into gear, against the other wheel, and find that the teeth of one does not come opposite the spaces in the other. Then you revolve one of the wheels, force them together again, and perhaps find the teeth in one still are not opposite the spaces in the other; and so you keep on wriggling till they slide into gear.





SPRING TOOTH FOR SLIDING WHEELS

Figs. 1, 2 and 3 show a simple arrangement for assisting the sliding into mesh of two such wheels. There is no need to alter anything in this arrangement, therefore, it could be added to any existing wheels. In Fig. 1 *a* is a strong flat steel spring, the lower part of which is made exactly the same shape as a tooth, and is fastened onto the sliding wheel exactly opposite a tooth on the same wheel. When sliding the wheel into mesh, it is turned round until the spring tooth comes opposite the other wheel. The wheels are then forced together, and the spring is pressed back against the tooth opposite to which it is fastened, as shown in Fig. 2, at *b*. One wheel is then slightly revolved, and as soon as the spring tooth comes opposite

the space in the other wheel, it springs into this space, preventing the wheels from revolving any further. When this takes place, you know the teeth in one wheel are opposite the spaces in the other, and the wheels can then be slid into mesh without any bother.

If four spring teeth are used, as in Fig. 2, then less than one-eighth of a revolution is necessary to bring one of the spring teeth opposite to the other wheel. In such a case, where the wheels revolve slowly and the headstock or machine is running idle, it may not be necessary to stop the machine, for the spring tooth if made strong, would drive the other wheel long enough for the wheels to be slid into mesh.

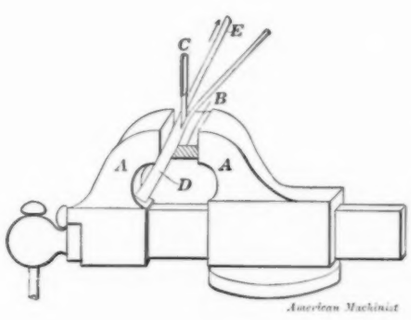
The double spring tooth as shown in Fig. 3, would help in such a case; it would be stronger for driving, as there would be two spring teeth in gear, and would allow longer to slide them into gear. The spring tooth could be let into the wheel as shown at *C*, to take the strain off the screws. Angle *d o e* represents about the space in which each spring tooth would act.

It is better, if possible, to have the fixed wheel fitting against a bearing, or against a collar on the shaft, as shown at *f;* the forcing of the two wheels together tending to loosen the wheel on its key.

Manchester, England. W. R. O.

Cutting Belt Laces

Here is a little kink on splitting belt laces from the hide, or cutting a narrow lace from a wide one. In the sketch *A A* represent the jaws of a vise. *B* is a piece of board with knife blade *C*



CUTTING BELT LACES

firmly driven in at a distance from the vise jaw equal to the width of lace required. *D* is the lace being cut.

The end of the hide, or lace, is first cut for three or four inches, as at *E*, then placed over the knife blade as shown, and pulled in the direction of the arrow, while the edge of the lace is guided along the vise jaw. It, of course, requires two persons to do this.

Anyone who uses the lace-cutting device which slips over the forefinger, and when in use nearly disjoints that member, will find this knife a real blessing.

A. D. SCOTT.

Brockville, Ontario, Can.

Keyway Cutting Kink

That trite, well-worn saying "Necessity is the mother of invention" is nowhere more often proved true than in the jobbing shop where life is truly "Just one d——— thing after another," and a minute saved is good money in your pocket.

Mother necessity was a good parent in the following instance and the kink is worth passing along for the good it has done.

The gears shown in Fig. 1 had to be done in rush time and required a ¼x⅜-inch keyway. Our keyseater being hope-

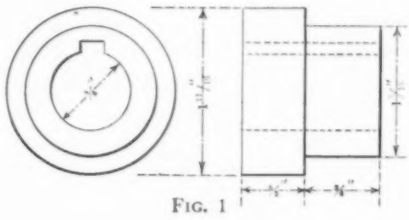


FIG. 1

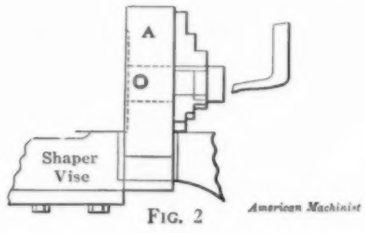


FIG. 2

A KEYWAY CUTTING KINK

lessly tied up, the next best method was a gooseneck tool in the shaper. It will be seen from the dimensions given, how difficult it was to hold the gears in the shaper vise without injury. We tried gripping them in the end of the jaws with the vise jaws lying parallel to the ram, also between V-blocks, and were about to bore a hole in an angle plate and clamp the gears thereon, when I hit upon the plan shown in Fig. 2. *A* is a universal chuck with the spindle plate removed. This was held in the vise with the jaws at right angles to the cut and the hub of the gear held in the chuck. This centered the job, held it square and rigid; no side adjustment was required after the first piece, and—it cut the estimated time for our shop in half.

Cleveland, Ohio. PAUL CAMPBELL.

Making a Pattern for a Grooved Wheel

During the experience of the amateur mechanic and "handy man" it often happens that some part of a mechanical appliance is wanted which, though it may be found in the market in some sizes, the particular size wanted may not be, and so must be made.

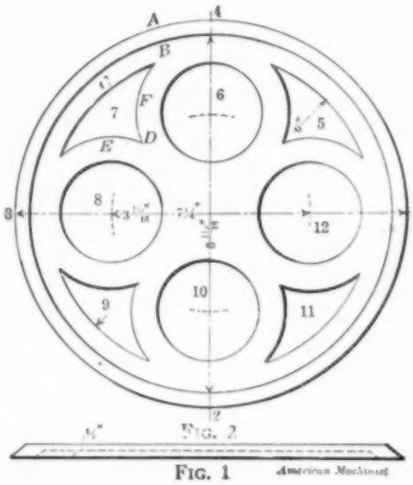


FIG. 1

PATTERN FOR A GROOVED WHEEL

This was my experience in searching for a cast-iron grooved wheel of dimensions here given. I decided, therefore, to make a pattern and have some cast. A grooved wheel pattern must be made in two parts in order to draw from the sand in the process of molding. My way of making such a pattern may assist others in a similar effort.

We will assume that the largest diameter of the wheel wanted is 7 inches, the diameter at the bottom of the groove 6 11/16 inches and the greatest thickness at the rim 9/16 inch.

It is only necessary to make one-half of the pattern in wood. First procure a good seasoned piece of pine and have it planed to about ⅜ inch thick, saw out a disk about 7 5/16 inches diameter and screw it as truly as possible to the face plate of the lathe. Better do it with several screws but taking care that they do not reach quite half way through the wood from the back as it is to be turned out.

Now face up your disk evenly to a thickness of ¼ inch at the rim and then take the stock out of the center to about one-half the thickness of the piece; following the course of the dotted lines in Fig. 1. The side should be beveled in toward the face plate as shown.

Having the disk turned and nicely sandpapered, lay it on your table with the small diameter up and with pencil point dividers strike the circles *C* and *D*, being sure that you are working from the

exact center of the wheel. The circle *B* is now to be divided into four equal parts and these points connected by center lines, as shown. Strike the small 1⅞-inch circles by using for centers the points where the lines cross the circles *D*. Using the same centers set the divider points 1 7/16 inches apart and lay out the lines *E F* to connect with circle *C*.

All the openings can then be cut out with a sharp knife and beveled on the outside of the half pattern and sandpapered. Put on a coat of shellac varnish and when dry sandpaper again.

From this wooden pattern procure two composition ones at the brass foundry. It may be asked, why not iron instead of composition? Simply because they would spring badly out of shape and could not be straightened except by facing in the lathe—wooden patterns are as bad—but composition may be straightened on a flat iron with some filing here and there. Having the two half wheels, place them together and clamp them to drill two small holes for dowel pins. One end of each pin should fit tightly in its hole; the other end loosely in the opposite hole so that the halves of the wheel pattern may easily separate in the molder's flask.

The hints here given, of course, will apply to any size wheel. In the exact center of the composition pattern should be drilled a hole—say, by means of which a hub of any size wanted may be attached. When the dowel pins are in place the edge of the openings should be filed so as to make them even with each other. If very particular the pattern may be finished in the lathe. I will say that mine was sufficiently true for my purpose and worked well.

The openings cut out in the web will greatly reduce the weight of the casting and give it a good appearance.

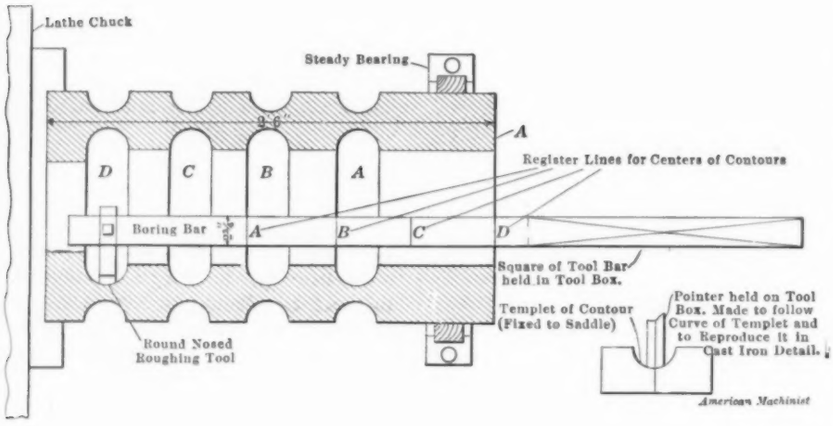
Lowell, Mass. C. S. BOURNE.

A Pointer from an Apprentice

These are jobs that come along to a machine shop, to which the ordinary methods of machining do not precisely apply. They are somewhat difficult to execute, in the ordinary way; but, with the exercise of a little ingenuity, they may be easily performed.

Such a case as shown in sketch came our way; a dozen of them. They required to be done pretty accurately and in good time. The contours on the outside of the cast-iron detail were, obviously easy to do, but those on the inside, especially those nearer the bottom of the bore, were more difficult.

An apprentice of ours, by a system of transference, showed us the way to do them. He helped his employers to get the job through smartly, and established a name for himself, and for which he will reap early advantage.



BORING UNSEEN CONTOURS BY TRANSFERENCE

The face *A* of the casting was his base line, and having marked his boring bar, by bringing those marks in line with the face *A* of the casting, he was able to precisely locate the center of each semi-circular contour: *D*, *C*, *B*, *A*. Also, to bring his tool "dead" to the bore line, he made a templet of the contour, and fixed it on his saddle, the saddle being fixed for each contour operation.

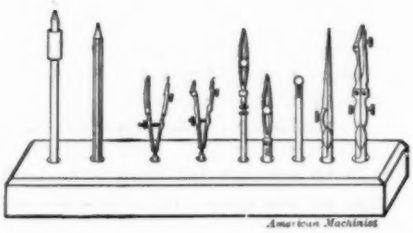
He then attached a pointer to his tool box, and having brought the line on the tool bar up to the face of the detail and set his scriber point to the center of the flat side of the templet, it was only necessary for him to closely follow the contour line of the templet, to effect a corresponding conformation inside the casting.

He got the metal out with a parting tool first, and was guided in his depth by having his pointer of the same width as his parting tool. He then used a round-nosed roughing tool, with a pointer having a round nose, and following this round the semi-circular side of his templet; the job was sufficiently accurate without the application of a formed tool.

London, England. F. H. HARRISON.

Instrument Holder

Every draftsman knows that as their drawing instruments accumulate, either on the drawing board or a tray, they become jumbled together, no matter how careful one is to keep them sorted out, and much time is consumed in poking them over to find the desired tool. The sketch shown here is not only a time saver, but a neat arrangement to keep them in order, and the instrument can be picked up instantly when wanted. It is made of maple, 9 inches long, 3 inches wide and 2 inches thick. The holes are ⅜, ½ and ⅝ inch diameter; the depths ¾ to 1¼ inches. As many holes can be drilled as required. They should be amply large, and deep enough, so that the instrument can be drawn out easily.

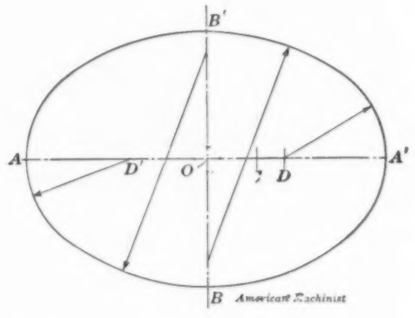


DRAWING-INSTRUMENT HOLDER

Hartford, Conn. J. E. COOLEY.

Drawing an Ellipse with Compasses

Accompanying, is a sketch of an ellipse drawn with circular arcs, the method of locating centers of which, while not new, is, I think, not generally known to draftsmen.



DRAWING AN ELLIPSE WITH COMPASSES

I have used the method with entire satisfaction and after becoming familiar,

it comes as natural as saying two and two are four.

After laying off the points, $A'A$ and $B'B$, through which the arcs are to be drawn, lay off on line $A'A$ the distance $A'C$ equal to OB or half the minor axis. Then with CA' as radius, draw arcs through B and B', using line BB' for centers. Next lay off CD equal to ½ of OC, and with D and D' as centers, and DA' as radius, scribe arcs through A' and A. These latter arcs will, if reasonable care is taken, come tangent to the arcs drawn through B' and B.

This method can be used only where the ellipse is not extremely flat, but I have used it for a number of years in general drafting work, and find it convenient, fairly swift, and it makes a good looking ellipse, such as is used to represent an oblique view of a hole or stud, etc.

Dayton, O. JACOB GOLDBERG.

Draftsman's Tool Case

I am sending you sketches of a home-made draftsman's tool case, which is a very desirable thing for all engineers and draftsmen. The general outside appearance of the case is shown in Fig. 1, and an inside view in Fig. 2.

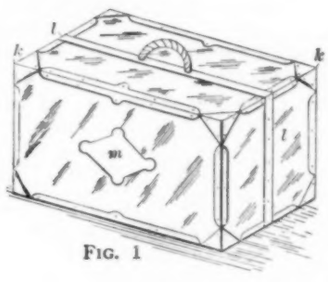


FIG. 1

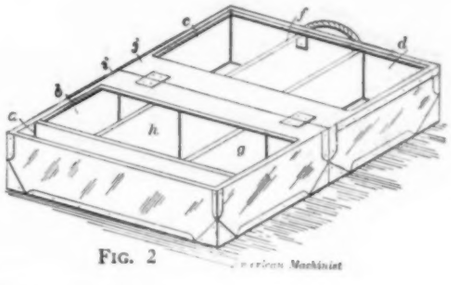


FIG. 2

DRAFTSMAN'S INSTRUMENT CASE

As will be noted, it has several divisions, which separate the tools. Of course, the size of the case will be larger or smaller as required by the particular set of tools for which it is made. For my set it is 14 inches long outside, and when closed is 7½x7½ inches. This construction gives me two trays 7½x14 inches in plan, and 3½ inches deep, when open. The walls are made of ¼ inch poplar boards, covered with pebbled bookbinder's-cloth, and bound with thin brass. The long division *a* is for my scales, *b* for box of thumb-tacks, erasers, etc. The large compartment *c* I use for catalogs and pamphlets, and find that it is a good plan to put the protractor, angles, and such, between these when packing up. In the space *d*, I keep my Engineers' Pocket Book and other small reference books. My instrument case, and wood angles occupy the central division *h*.

The strips *i* and *j* form partitions when the case is closed, to keep things from getting jumbled. The strip of metal shown at *f* serves two purposes—it is a brace for the lifting handle when the case is lifted, and keeps the catalogs, pamphlets, and other papers, in place when the case is closed.

Build the two boxes, put in the partitions, put on the hinges, then take out the screws from one side of the hinges so that the boxes are separate. Get pebble grain bookbinders' cloth, and cut to fit the several sides. Give the box a coat of shellac; give the cloth a coat of shellac on the side that is to go next to the box, and in a few minutes shellac one side of the case, and the piece of cloth for that side, and put the cloth in place while the shellac is "tackey." Repeat for all sides.

The brass corners *k k* you can get at the hardware store for 5 cents each. To bind the corners, procure some square brass tubing, and by filing on opposite corners split it into angles, or buy angle brass. Shape to suit your fancy and fasten on. Right here you will need a small hand drill stock, and some small wire drills. At the hardware store where you buy your corners, you can get small brass tacks called escutcheon pins. These are made in several sizes, but for the work in hand No. 16 will be about the size needed. Get your drill to match your pins, and drill your corners and angles, and drive the pins, cutting them off on the inside of the case with a pair of nippers. Put the hinges back in place, and put on the seam strip *l*, your fancy name plate *m*, and the outside of the case is done. The inside may either be treated to several coats of shellac, or it may be lined with thin silk, or cotton cloth.

While we have so much daylight after work hours, this case can be made on over time, and if carefully done it will be something to be proud of. A collapsible handle made of a brass chain is best, and will, of course, look better if one can get it plated.

R. W. J. STEWART.

Chattanooga, Tenn.

A Few Recollections of an Apprentice Machinist

I often look over my hands and wonder how does it happen that all my fingers are practically intact. It is probably luck, nothing else. Turned loose in a small country machine shop at an early age as apprentice machinist, but used as general help and "utility man" for some little period; at least, until after I got over my scare. Apprentice machinist—all that an apprentice can learn in a shop of that character is what he could discern from personal observation. Machinists, as a rule, were not very liberal with information of the right kind. Once in a while someone would give you some good advice, but that was the exception rather than the rule.

If you desired information as to how to turn a taper, you were told to shift the end of the lathe around; or, if information was required as to chasing a left-hand thread—to stand at the back of the lathe and reach across with a stick. In the modern machine shop the apprentice still has to find out all about round-squares, strap-oil, struggling-bars and the rest of that catagory, but he certainly has a better time of it, especially in the larger shops. Altogether, it has been found that it pays to give the boy proper instructions and to caution him to keep his hands out of the gears.

Imagine a green boy being ordered to oil the overhead shafting, the planks being used for that purpose were laid loose and no definite route mapped out, no instructions except to "be careful and not to put all the oil on the floor." One of the first things I did was to tip the contents of an oil drip cup down the back of a grouchy old party operating a shaper and intent upon his work.

The next thing of importance was to project the ladder through a moving pulley, which luckily was split, the shock causing it to loosen and slip on the shaft; but before it loosened, it sent the iron heel of the ladder into the floor close to my foot and they had to back up some to get it out. I don't know who was startled the most, the ladder, the pulley or myself. I was somewhat careful after that, but later lost a portion of the same ladder in the same way, the pulley not stopping that time.

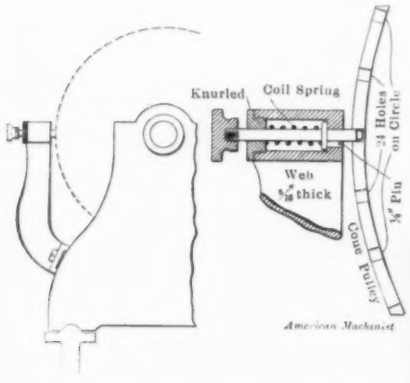
Anyhow, to make a long story short, before I reached the age of discretion I did most of the fool things of which a boy is capable, such as riding on a running belt, not appreciating the destructive power of which it was capable; stopped the lathe by catching the belt on the front side and starting the shipper without tightening the tool; allowing the chuck jaw or dog to snatch an oil lamp from my hand; getting on a stool to replace the belt of an emery wheel and sit-

ting down on same after it had started; studying the blueprint after completing the work, and many others, as will apprentices for years to come. But his work can be rendered safer by systematic instructions and supervision which he now seems to be receiving. Some effort, however, should be made to reach the smaller shop where the old conditions still exist.

Pittsburg, Penn. C. C. HOWE.

Indexing on the Cone Pulley

The accompanying sketch shows an attachment we have put on our pattern-shop metal lathe. A good part of our



ATTACHMENT FOR INDEXING ON CONE PULLEY

work consists of square, hexagon and octagon nuts and by the use of this attachment the laying off of the flats is a comparatively simple job and much better and quicker than doing the same work with a pair of dividers.

The holes shown are drilled through the largest part of the cone pulley and the attachment is put on by means of two bolts as shown. The small pin on the front end fits into a slot and by drawing back the handle and giving it a turn the index pin is drawn back and held out of the way. Any number of holes may be used but 24 is a good number. These holes are numbered.

A tool with a sharp scriber point is used in the tool post of the compound rest and vertical adjustment can be obtained in starting the lay off by raising or lowering the point of the tool.

It is only the work of a moment to put on or take off this piece and the one we made paid for itself in the first week we had it in use.

Avalon, Penn. THOMAS A. HUGHES.

A Leveling Jack for Locomotives

The halftone, Fig. 1, shows the application, and the line cut, Fig. 2, shows the details of a leveling jack, which is in use on a large Western railway. The foreman of this road suggested that the

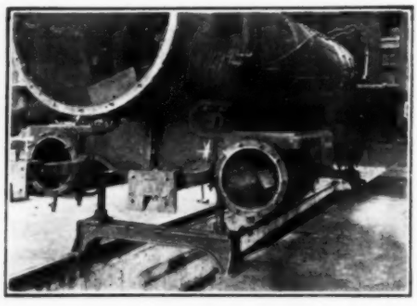


FIG. 1. THE JACK IN USE

base castings be made 7/8 inch thick where the drawing shows 5/8 inch. This, because the engines on his road are somewhat light, and this alteration would make the jack heavy enough for all classes of engines.

New York GEORGE WATSON.

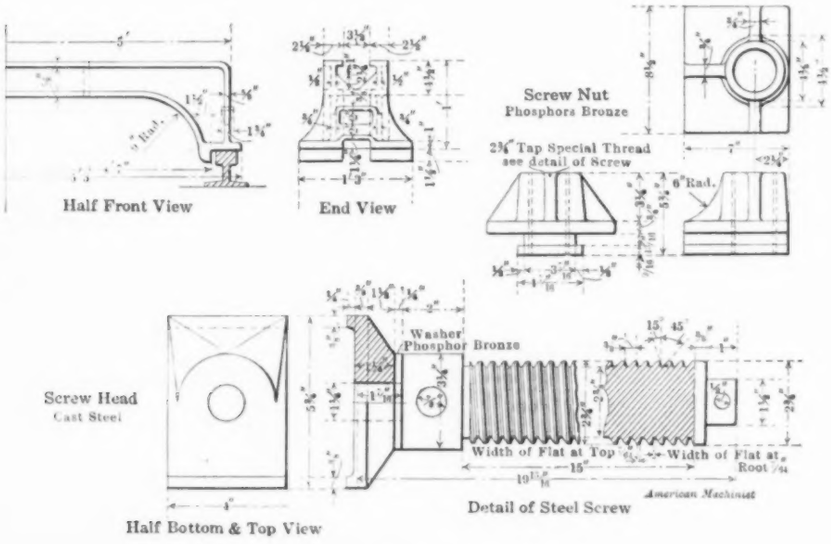
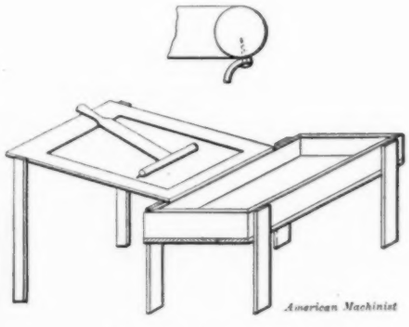


FIG. 2. DETAILS OF THE JACK

Substitute for a Blueprint Wringer

The cuts show a method which was quickly applied and which proved satisfactory. I got a large drawing board, put one end of it on the fixing tank, and elevated the other end to an angle of about 15 degrees and fastened.

The points were pulled out of the tank upon the board, so as to lie flat upon it without wrinkles. Then starting at the top, we ran down over the prints with



DRYING BLUEPRINTS

the rubber squeegee shown over the point and in the enlarged view above. It was made by tacking to the stick used for immersing the prints a longitudinal quarter section of a piece of hubber hose.

The lower edge of the rubber was trimmed straight, so as to bear evenly upon the print its full length. The rubber was put on with the convex side toward the handle, thus removing all danger of injuring the print, and adapting itself to the surface of the board in a way that secured an even bearing along its entire length.

Five or six prints can be put on the board at once, and with one application of the rubber all the surplus water is taken out, so that the prints can be hung anywhere to dry without water dropping from them.

Waynesboro, Penn. C. P. HARRISON.

The total value of the foreign commerce of the United States during the fiscal year 1910, which ended on June 30, was $3,302,821,057. The total imports were valued at $1,557,854,854, exceeding those of 1907, the previous high-record year, by more than $123,000,000. The total exports were exceeded only by the years 1907 and 1908, and were valued at $1,744,966,203, falling $136,000,000 behind 1907 and $116,000,000 behind 1908. They exceeded 1909, however, by $82,000,000.

Mounting Pressures for Car Wheels

Committee Report

Abstract from a paper presented at the Master Car Builders' Convention at Atlantic City in June, 1910.

Proper mounting of wheels depends on the grade of workmanship in turning the wheel seats and boring the wheels.

It has further been demonstrated that the work can be done properly without any additional cost over a lower grade of workmanship and with the same grade of men as ordinarily employed. The men employed on this class of work usually become experts and can, if properly instructed, turn out work of the best character.

It is important to remember that good work cannot be performed without good tools. Proper shop practice will not permit lathes and boring mills to get in bad practice. The axle, roughly turned in this way, cannot be accurately calipered, and this is the essential to good fitting and security. Furthermore, in mounting the wheel, the high ridges obtained with a roughly turned wheel seat are pushed off, principally at the outer end of the axle, reducing its diameter and making the turning of the wheel seat necessary when preparing the axle for mounting wheels at a later time. There is, also, a bad moral effect on men, who, if permitted to carry out this practice, will extend it to journals as well.

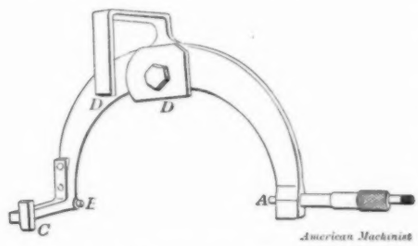


FIG. 1. CALIPER FOR WHEEL SEATS

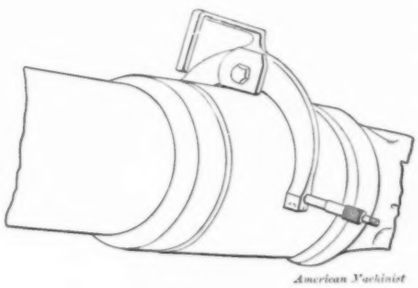


FIG. 2. CALIPER RESTING ON WHEEL SEAT

It has been demonstrated that with fairly rigid lathes axles can be turned at a speed of 40 to 50 revolutions per minute, the limit of speed being the chattering of the tool rather than the cutting speed. With this high-speed run with a fine feed, an axle can be turned in about the same time as by slow speeds and coarse feed. The higher speed results in better work without increased cost.

Having secured straight and true wheel seats and wheel bores, the next necessity is for the proper diameters necessary in secure mounting.

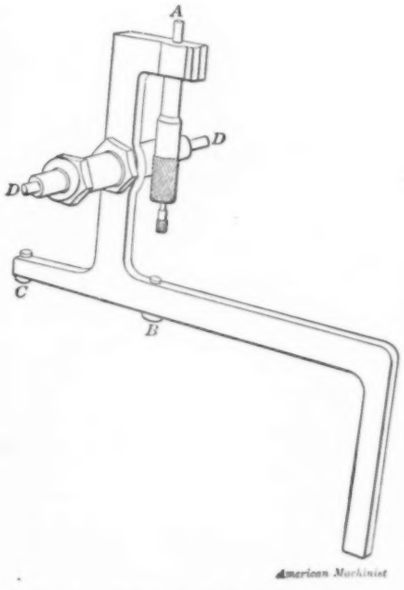


FIG. 3. CALIPER FOR WHEEL BORE

Micrometer calipers are necessary for several reasons. The axles and wheels can be calipered more quickly and more accurately than by machinist's calipers or snap gages. The "draw" or difference in diameter of wheel seat and bore which has been determined for a proper fit, can be secured without difficulty. The difference between diameters of wheel seat and bore of wheel expressed in thousandths of an inch, can be measured accurately, whereas with ordinary calipers it is a question of skill of the workman and with snap gages the same is true to a lesser degree.

To successfully use the ordinary trade micrometer caliper for wheels and axles, takes time and a certain amount of skill. To reduce this time and skill to the minimum, micrometer calipers have been designed and used successfully. Fig. 1 shows a caliper for wheel seats. *A* is an ordinary micrometer head that can be bought in the open market; *B* is the anvil; *C* is a stop set square with a line through *A* and *B*; *D* is a stop or limit which may be turned, so that the distance from the stop to the line from *A* to *I* shall be approximately the radius of the wheel seat. In practice, this stop *D* for the 5½x10-inch journal axles is correct for wheel seats 6⅞ inches in diameter, and is approximately correct for wheel seats from 6¾ inches to 7 inches. By turning the stop *D* one-quarter turn, it is suitable for 5x9-inch journals.

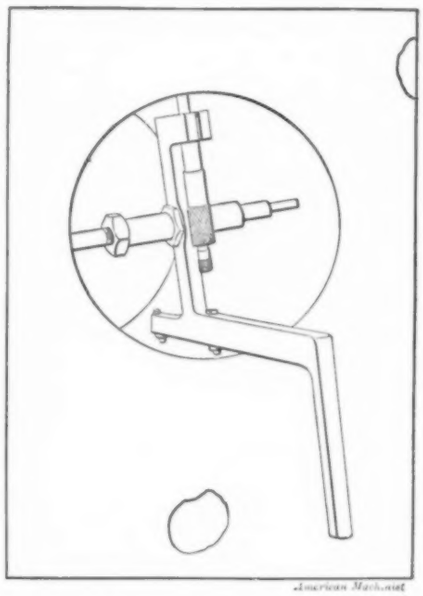


FIG. 4. CALIPER ADJUSTED TO WHEEL

In using this caliper, it is placed over the axle, with stop *D* resting on the wheel seat, as shown in Fig. 2. The stop *C* and anvil *B* are then brought firm against the wheel seat. The micrometer is

screwed up by a ratchet stop until the ratchet clicks. The caliper is then removed and read. On a trial, eight axles were measured in five minutes and twelve wheels were measured in the same space of time. Each wheel seat was measured at three points, the average taken and size chalked on the axle. The wheel seats had not been previously measured and but few were of the same size. This is much more rapid than calipering by other means, especially for axles varying in diameter.

Fig. 3 illustrates a caliper for wheel bore. *A* is the micrometer head, but graduated for internal measurements; *B* is the anvil; *C* the stop, set at right angles to a line from *A* to *B*; *D D* are right- and left-hand screws, turning together by means of a link not shown.

In calipering a wheel the screws *D D* are roughly adjusted somewhat smaller than the bore of the wheel. The anvil *B* and stop *C* are brought against the bore and micrometer screwed out until the ratchet clicks. See Fig. 4. On a trial five wheels were calipered and size chalked on wheel in five minutes.

The measuring was done by an apprentice, who was able to do it in an entirely satisfactory manner after about one hour's instruction.

This method of calipering and marking each wheel seat with the points and the further calipering of the bored wheels with the sizes marked upon them permits the proper selection of wheels at wheel seats for mounting, in order to secure the pressures necessary.

As to mounting pressures, your committee recommends the following, in conjunction with the character of workmanship already referred to, as being an essential in the problem.

The following general specifications, which have been quite thoroughly tested, are submitted for consideration.

Axle Wheel Fit

Must be turned as smooth as possible with lathe tool having flat cutting edge. Finishing cut must not be taken with lathe feed coarser than 16 pitch. Taper on axle-wheel seat for entering wheel must not exceed one-half in length and must be turned with broad, straight-faced tool, making regular taper without ridges or rings. Wheel fits to be calipered at three points, namely:

One inch from each end and middle and other points if indications point to excessive variations in diameter.

Axles shall not be considered as suitable for mounting where there is a difference in diameter between any two measurements exceeding 0.003 of an inch. This, however, shall not be construed to mean that wheel seats on each end of axle are to be of one size. Each tenth axle from each lathe shall be measured for soundness. No axle varying over 0.001 of an inch when measured at two points 90 degrees apart on circumference at equal distance from end shall be considered as suitable for mounting.

Wheels

To be bored smooth. Finishing cut shall be made with tool or tools having a cutting face at least 3/16 of an inch wide. Feed not to exceed 8 pitch. To be bored with a rough and finishing cut. The finishing cutter when taking the finishing cut must not be cutting when roughing tool is also rough-boring, unless the finishing tool is supported independent of roughing tool, the latter to prevent spring of roughing tool being transmitted to finish tool, causing an irregular bore.

Wheels to be calipered with micrometer caliper. A wheel varying over 0.002 of an inch in any two diameters will not be considered satisfactory for mounting.

Mounting presses to be provided with recording pressure gages. All wheels not mounted within limits given, or wheels that are forced against shoulder, to be withdrawn.

One point that may be foreign to the subject should receive attention, which is lathe centers. It would be very desirable if all shops were to adopt one angle. Generally, lathe centers used for ordinary work are 60 degrees, including angle. If this were adopted for all axle work, it would result in the axle running true on centers, reducing the amount of material necessary to turn away when truing up axles that have been previously turned.

Autogenous Welding in the Foundry*

By Henry Cave†

Autogenous welding is the uniting of metals by heat alone, without the intervention of any other metal.

The blacksmith's weld is not autogenous, because he uses pressure to bring the parts together; brazing is not autogenous, because a different material is used to unite the parts; the foundryman's "burn" is really autogenous welding, but the heat is obtained from a large mass of molten metal. The system we are discussing, however, obtains its heat by means of the combustion of acetylene with pure oxygen, which produces a temperature of 6200 degrees Fahrenheit. What this temperature means can best be realized by the fact that if an ordinary thermometer registering up to the boiling point, was eight inches long, it would have to be extended 21 feet to measure this temperature on the same scale.

The reason for acetylene giving such an intense heat when burnt with pure oxygen is due to the large amount of carbon in its composition, and also to the fact that the nitrogen in the air is eliminated, resulting in the intense flame, which can readily melt a small section of a casting of any size.

It is necessary, however, where a weld of any thickness is required, to remove the metal by making a groove, so that the flame can come in contact with the metal on the bottom, which is fused, and then additional metal can be added from a rod of the same metal until the whole becomes one solid mass. In this way metal can be added to increase strength or change the design, such as the addition of bosses, or to fill in places where the mold has not filled, to weld up blow holes, or to replace parts that have been broken off, or to weld up shrinkage or other cracks. Tests of cast-iron welds have shown a strength of 25,000 pounds per square inch.

In considering the uses of this equipment, foundrymen should bear in mind that the value of their defective castings to them is not only the labor expended on making the mold, as is frequently assumed, but that the percentage of defective castings also means a proportionate increase of pro-rata expenditures. This is particularly the case where a foundry is running to its full capacity, as the castings saved are a direct increase of production, without any material increase of pro-rata expenses, and in many cases if the castings were scrapped and new ones made, there would be the same percentage of loss in the new ones, and this also should be borne in mind, in considering the possibilities of making a saving by the use of the oxy-acetylene torch.

This process also is considerably used in the steel foundry for removing risers. This is carried out by means of an oxygen jet, and is based on the phenomenon shown by the elementary scientific experiment of inserting a red-hot iron wire into an atmosphere of oxygen which will immediately cause it to burn.

In cutting, a small spot is heated up by means of the oxy-acetylene flame, and a jet of oxygen is projected on to this hot metal from a separate orifice, the metal being burnt or oxidized away, where the jet strikes, with the result that

*Abstract of paper read before the American Foundrymen's Association convention at Detroit, June, 1910.

†President of the Autogenous Welding Equipment Company, Springfield, Mass.

a cut is made similar to that produced by a saw.

Extensive tests have been made as to the cost of carrying out this work, and it has been proved that steel risers can be cut up to 6 inches in diameter at a cost of 1 cent per square inch, whereas the cost of cutting by cold saw under the same conditions was 1.5 cents per square inch. The torch cut 150 square inches per hour as against 27 square inches for the cold saw. The figures for the cost of cold sawing, do not take into consideration power consumed, or renewal of saws. I found that the cost of one of these cold saws, as exhibited at this convention is $1100; the cost of the saw is $110.

The oxy-acetylene cutting equipment might cost considerably less than the cold saw, and it would be capable of carrying out the same amount of work as five of these saws, the floor space being proportionately less, so that there is a very great advantage in every way.

Lantern slides were used to illustrate parts that had been welded or cut up by means of the Davis Bournonville Company's welding apparatus.

A Gear Hobbing Machine

By E. A. Dixie

A simple automatic machine for hobbing the finer grades of spur, spiral and worm gears used in meters, phonographs, clocks, etc.

Its production compared with that of a machine using a rotary cutter.

The illustrations show a gear-hobbing machine and some of its product. This machine, invented by Mr. Catucci, of Newark, N. J., has been given a try out during the past four years on gears up to 10 pitch. Large numbers of these gears have been used in fine fishing reels and water meters where the requirements are particularly exacting. The performance of the machine has been so satisfactory that it is now being built for the market by the Meisselbach-Catucci Manufacturing Company, Newark, N. J.

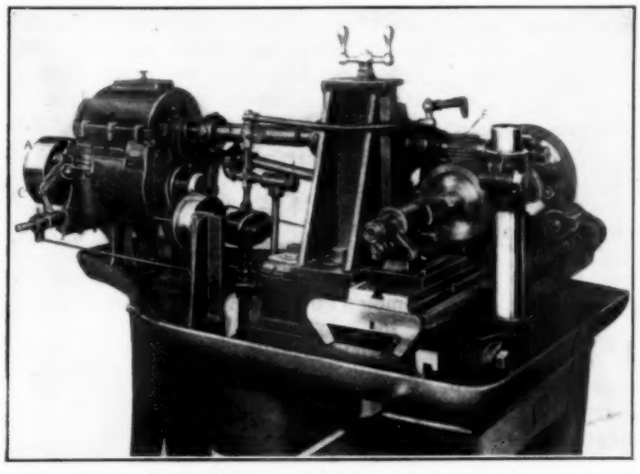


FIG. 1. REAR VIEW OF GEAR-HOBBING MACHINE

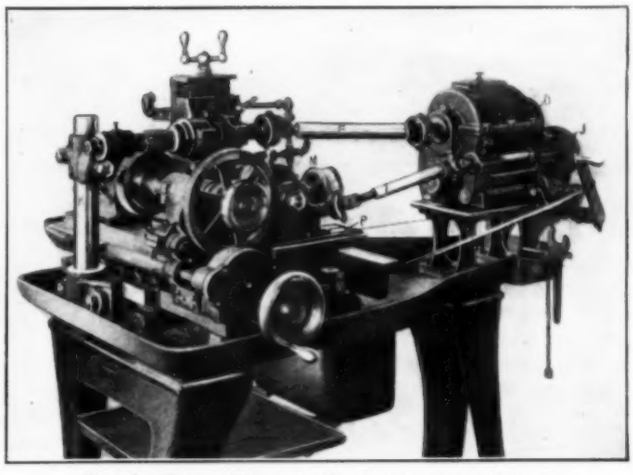


FIG. 2. FRONT VIEW OF GEAR-HOBBING MACHINE

A, Fig. 1, is a clutch-driving pulley which drives the gears in the gear box *B*, giving three speeds controlled by the lever *C*. The drive from the gear box to the hob *F* is through the shaft *E* provided with universal joints to permit the raising and lowering of the hob on the housing *G*, and also the swiveling of *G* on the base. On the rear end of the shaft *E* is mounted a gear *D* which meshes with a similar size gear *J*, Fig. 2, which drives the shaft *I*, also provided with universal joints, at the same speed as *E*. On the end of the shaft *I* is a worm which meshes with a worm gear on the shaft of which is mounted the spur gear *M*. The work spindle of the machine derives its rotary motion from this gear *M* meshing with a suitable change gear *N*. The worm and worm gear just referred to run in a bath of oil in the inclosed box *O* which is adjusted to and from the work spindle to permit the gear *M* to be meshed with various sizes of change gears.

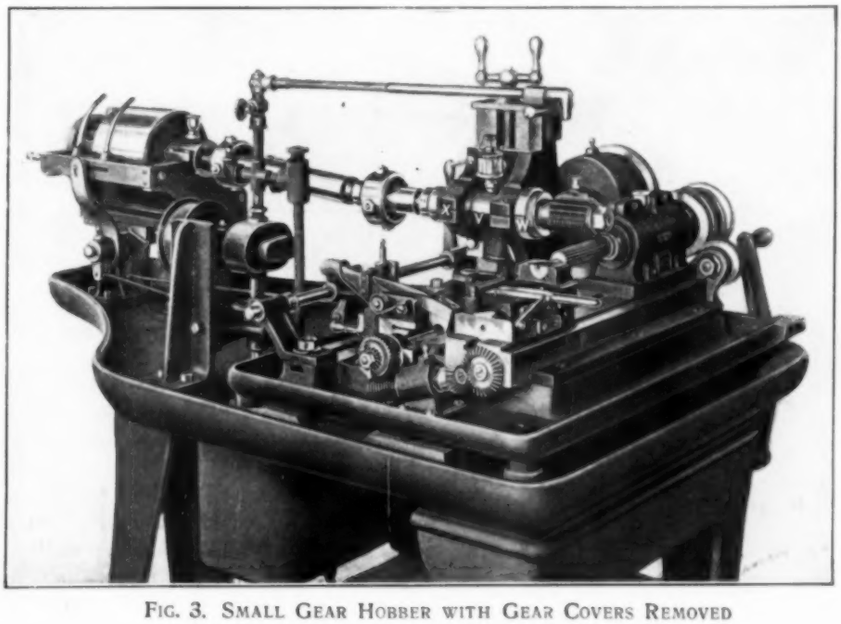


FIG. 3. SMALL GEAR HOBBER WITH GEAR COVERS REMOVED

Mounted on the work spindle, just behind the gear *N*, in Fig. 2, is a gear which drives the feed mechanism through the train of gears *Q*, *R*, *S*, and those inside the cover *T*. The handwheel *L* is for rapid traverse of the work slide. The housing *G*, Fig. 1, pivots on the base and has a graduated arc at *H* for setting it and the hob which it supports at the correct angle with relation to the work.

By referring to Fig. 4 it will be noticed that the hobs are marked on the end in degrees, etc. These marks give the angle

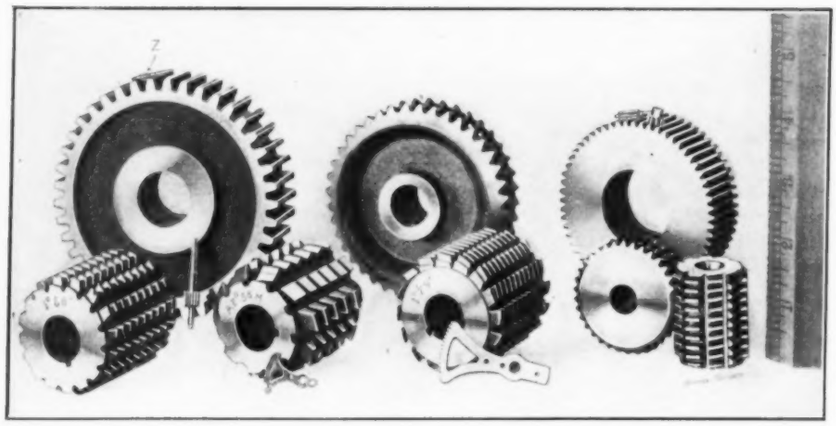


FIG. 4. SOME HOBS AND GEARS

at which the housing *G* is to be set for cutting spur gears. In operation the machine is entirely automatic, after it has been set up and the blanks secured in position a slight movement of the lever *U*, Fig. 2, throws in the clutch on the driving pulley and also starts the oil service. When the gear is cut, the machine stops and at the same time shuts off the oil supply. The gear cutter shown in Figs. 1 and 2 will cut spur, spiral and worm gears up to 10 pitch, 7½ inches diameter by 6 inches face. Fig. 3 shows the smaller size of machine specially designed for small work, which has a capacity up to 16 pitch 4½ inches diameter by 4½ inches face. The principle of this machine is the same, but the construction is slightly different from that shown in Figs. 1 and 2. Owing to the position of the camera the feed shaft is hidden by the hob shaft. The hobs used in these machines are about 2 inches face, which gives them a long life between grindings. The quill *V*, Fig. 3, is adjustable endways in the two split clamping brackets *W* and *X*, so that when one part of the face is dull the hob can be moved endways and a new part of the face used. Fig. 4 shows a selection of iron and bronze gears all cut on the small machine. These include spur gears and segments and a worm gear and its hob. The small pinion *Z*, Fig. 4, is of brass ⅛ inch outside diameter, 6 teeth.

The large gear shown to the left in Fig. 4 was cut on the small machine as a test to see what it could do. It is a cast-iron spur gear 10 pitch with 42 teeth 1-inch face and was cut in 18 minutes.

Owing to the small number of gears in the machine (13, exclusive of those in the gear box, in the large machine and 9 gears and two worms and worm wheels in the small machine), the cutter spindle can be run at very high speed. On small pitches in brass the spindle speed is between 1500 and 1600 revolutions per minute.

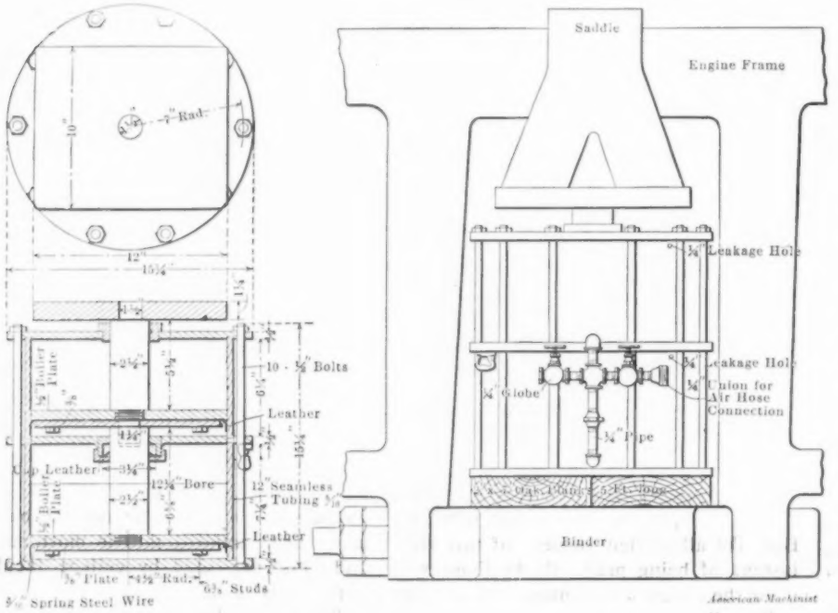
Regarding the life of the hobs; one hob cutting small brass gears 60 teeth, 53 pitch 0.004-inch face, cutting 35 in a stack, has been turning out 5000 every working day of 10 hours for the past fifteen months; equal to one tooth over 75 miles long. This is asserted to be double the output of the rotary cutter machine on which the work was previously done, while the quality is also better.

Air Jack for Locomotive Saddles

By W. J. Shadle*

The accompanying drawing shows an air jack that is used between driving-box jaws on Atlantic type locomotives to raise the saddle and tension of driving springs the required hight for blocking between saddle and engine frame. This method allows the drop-pit jack to pump only the driver and boxes up to saddle and prevents the extra pressure which would be applied to drop pit jack when pumping up the driver and boxes, as well as the tension of springs.

*Shop foreman, Chicago & Northwestern Railroad Company, Clinton, Ia.



DOUBLE AIR JACK FOR LOCOMOTIVE SADDLE

I wish to call particular attention to the construction of this small air jack and its power. As there is 20,070 pounds downward pressure on each driving spring, it would have taken a 19-inch air jack to raise the saddle and spring the required amount, and as the jaws had only 15½-inch opening, we could not use the 19-inch jack. To overcome the close quarters, we designed this double 12¼-inch air jack, which is equal to, and will lift as much as a single jack 19-inch diameter. This jack is constructed with a partition head in the middle, with packing leather around piston rod to confine the air independently in each cylinder. Air is admitted to each cylinder at the same time, as shown, by ¼-inch globe valve. A ¼-inch leakage hole is placed in top of each cylinder to prevent equalizing of air.

This 12¼-inch jack has 112.91 square inches area in top cylinder, which will lift 11291 pounds with 100-pound pressure. The bottom cylinder has an area of 117.81 square inches, and will lift 11,781 pounds, making a total of 23,072 pounds for the two combined, with 100-pound air pressure.

This form of jack has proved very effective.

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American Machinist

Editorial

Fairness in Buying Machine Tools

There are two sides to the question of selling and of buying machine tools. And there is just as much need of honesty and good faith in buying as in selling.

The desire of machine-tool builders to have their machines used so as to give satisfactory results has led to their sending demonstrators to show how they should be run, to planning how the work should be handled and assisting the user in other ways. This is a proper spirit, but it does not always meet with the response and coöperation that it should.

Some buyers forget that they buy a machine for their own benefit and profit and not as an act of charity to the builder. And no matter what happens to the machine or to the work it is doing, it is up to the builder to make it right. In shops of this kind, breakages are always due to defective castings and never to careless operation or to an accident. Hot bearings always mean poor workmanship and never poor oil or lack of attention, and the maker realizes that one dissatisfied user of this kind can harm his reputation to a marked degree. Whenever anything goes wrong, this kind of a user wires, often collect, for a man to be sent regardless of the expense it entails on the builder.

This is one of the wrongs that can hardly be righted by any form of contract, but must depend on the sense of fairness and justice of the buyer. You can write into the contract that time will be charged when a man is asked for and the machine is not at fault, but it is easier to write it than to get proof and collect the money due. Yet any fair-minded man realizes that after a builder has started his machine so as to do satisfactory work, he cannot be expected to send a man every time anything gets out of adjustment. And any expense incurred in this way, at the user's request, should be paid for willingly.

And, after all, there is nothing gained by these methods, because the loss cannot be borne by the builder. He adds this expense to his overhead charges, and in this way it gets back to buyer after all. But, like all shifted burdens of this kind, instead of being paid only by those who incur the expense, the innocent and guilty suffer alike.

The only remedy seems to be an awakening of fairness and justice in the buyer as well as the seller to the end that all may be benefited.

Which Technical School for the Boy?

This country is blessed with many technical schools, and doubly blessed because they are all different. It is noticeable, however, that young men choose the school which they will attend with very little thought as to which is the best adapted to their individual cases. Too often the choice depends on the location, whether near home or in some large city with its attendant amusements, on the advice of some graduate, or it may have had a successful football season. All of these things are taken advantage of in the solicitation of pupils.

Seldom does a boy go to a particular school because he will there sit under some exceptionally capable and brilliant engineer as a professor. Hardly ever is the list of members of the faculty scanned more than to count its numbers. In too many cases the man who accepts a chair in a technical school or college buries himself from the world from which students come. It is also notorious that the exceptions to this rule do not draw students to the schools which they represent in nearly so large proportions as a senior with a high batting average.

This in a measure will account for the large proportion of instruction that is given by men of the grade of instructors or assistants, and the public has the matter in its own hands, as the moment the engineering ability of the faculty is questioned by prospective pupils this practice will be reformed.

The question of expense is often a large one. Tuition varies, not in proportion to its worth but according to the endowment of the school and its popularity.

In general a boy who wishes to make his way can get through any school. In some he will find that everyone else is doing the same thing; in others, that the boy who works is the exception and also that he is a social outcast. The last he will do well to avoid, for the one part of a technical training that is most needed and most neglected by college faculties is the social side.

The size of the school has an important bearing in that the smaller the school

the more the individuality of the professor makes itself felt upon the boy, and yet that professor's efforts may be distributed over so many subjects that he may not be able to be the master of any.

A boy with a faculty for studying things out himself may get more good from the small school while the boy with a good memory and some self-assurance, may profit more from the large one.

A boy whose life has been in the city, whose athletic tendencies are those of some of the larger preparatory schools, may settle down to the point where his mechanical tendencies can come to the surface sooner in some school which is independent of a university. On the other hand, a boy whose sole delight is books and who has attained a measure of maturity, may be greatly broadened by contact with the athletic and social spirit of the school which is a department of a university.

Laboratory equipment is one of the great talking points with some of the larger schools. This should be looked into carefully to see whether it is capable of profitable results or whether it is merely useful as a talking point. Some of the brightest men of our acquaintances were educated in the "white pine and shellac" stage of laboratory development, where all apparatus was homemade. The way in which apparatus is handled and the instruction which goes with it has vastly more to do with the education of the student than its quantity.

Of all things, special attention should be paid to the shop work of the student. Careful study as to its amount and quality will show radical differences in schools. Of all things choose a school where the shop work makes itself felt as a large factor in the curriculum rather than one where it is inserted edgewise in an apologetic form. Also watch out for its quality; as to whether the work is done by the student as a copy of something or whether it is done as an original act on his part. Elaborate instruction sheets and lock-step methods may do for manual-training work but they have no place beyond the earliest months of an engineering course.

It has been possible for us to touch only on a few of the more prominent questions which every boy and his father should consider carefully before choosing a school, but if even these are considered, much annoyance and regret may be avoided.

Marine Engine Draftsman

The United States Civil Service Commission announces an examination on August 24-25, 1910, to secure eligibles from which to make certification to fill a vacancy in the position of marine-engine draftsman, $1800 per annum, office of the chief of engineers, war department, and vacancies requiring similar qualifications as they may occur.

The examination will consist of the subjects mentioned below, weighted as indicated:

1. Mathematics and calculations (algebra to quadratics, solution of plane triangles, and problems in steam engineering and machine design) 20. 2. Materials of construction 15. 3. Drafting 30. 4. Training and experience (rated on application and examination form 1312) 35.

Applicants must have had at least ten years' experience. Graduation in mechanical engineering will be considered equivalent to four years of this required experience. Experience in dipper and hydraulic-dredge design is desirable.

Applicants should at once apply to the United States Civil Service Commission, Washington, D. C., for form 1312.

Proceedings of the Twelfth Annual Convention of The National Metal Trades Association

We have been favored with a copy of the synopsis of the proceedings of the twelfth annual convention of the National Metal Trades Association, which was held in New York City, on April 14 and 15 of this year. This is a volume of over 170 pages, splendidly printed and illustrated, and contains the addresses presented at this meeting. This makes a convenient way of preserving the suggestions presented at that time, and we have no doubt will be used as a ready reference by those who are interested along this line of work.

Metal Trade Outing at Worcester

The Worcester branch of the National Metal Trades Association held their annual outing at Edgemere, on Lake Quinsigamond on July 22. Representatives from Providence, Fitchburg, Hudson, Athol and other New England points were represented so effectively that the base ball team of the Worcester men were beaten by the outsiders; and this in spite of the fact that the scribe played right field for the visitors.

About 80 members and guests sat down to a splendid shore dinner which was enlivened by a good band and other entertainment. On the way home, visitors were shown the beauties of the surrounding country through the courtesy of members having automobiles available.

This is one of the liveliest branches in New England, and Secretary Tullock and John W. Harrington, B. Austin Coates and John C. Stewart, the entertainment committee, all deserve great credit for the arrangements as well as for the spirit of cordiality which every visitor feels.

Continuation Work in New England

The Worcester, Mass., Trade School is enlarging its field of usefulness by the adoption of the continuation school work after the Cincinnati plan.

Director E. H. Fish reports a healthy interest among the manufacturers of Worcester and expects to start in the fall work with about 150 apprentice boys divided into 10 classes of 15 boys each.

The idea is also taking definite shape in Providence, R. I., and while the number will probably be comparatively small at first, it gives promise of developing into a permanent institution.

New Publications

Work, Wages and Profits, by H. L. Gantt. 194 pages, 5x7 inches, Published by the Engineering Magazine, New York. $2.

This little book outlines the author's ideas regarding the factors which enter into economical production in modern manufacturing. It carefully considers questions which are too frequently overlooked by those who are striving to increase production and profits.

Mr. Gantt meets all the problems squarely and shows how efficiency necessitates proper instruction and how increased production must also mean increased compensation if the best permanent results are to be obtained.

The subject is treated under a number of different heads such as Efficiency, Compensation, Day Work, Piece Work, Task and Bonus Systems, Training Workmen in Habits of Industry and Coöperation, Fixing Habits and Prices and Profits.

A careful study of this book by both employer and employed, should do much to clear the atmosphere regarding both production and compensation and enable both to look at the question in a broader way than is usually done.

National Machinery Company's Exposition

The National Machinery Company, Tiffin, O., are planning to hold an exhibition in their shops on August 19, 22 and 23.

They will exhibit about fifty of their bolt- and nut-forging machines, and to those interested in that line of work a visit during the exhibition days will no doubt prove pleasant and profitable.

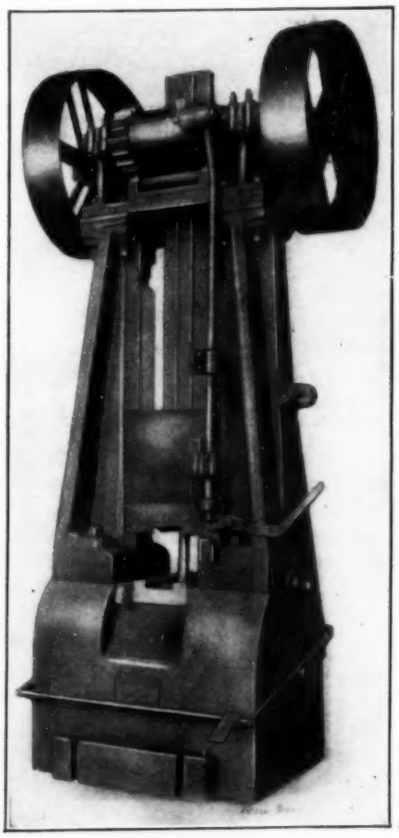
New Tools and Shop Appliances

A Drop Press

The machine shown in the halftone is constructed along conventional lines, there being nothing particularly new, but in making the new design the object was to produce a substantial machine.

The machine is of the geared type, both pulleys being on the back shaft, which makes the front shaft practically stationary, excepting the slight amount of rotation due to the movement of the front rod. This front shaft is, of course, eccentric which gives the necessary amount of motion to the rolls to grip the board. The rod, of course, is practically a counterweight and actuates the eccentric due to its weight hanging on the front arm. This rod, in its upper position, is supported at its lower end on a hardened steel shell and the hammer, in its descent, pushes the rod forward by reason of the cam surface on the face of the hammer coming in contact with the lower dog. This forces the rod forward off the shaft and it falls onto the bottom step. This bottom step is cushioned with leather and fixes the low position of the rod, and at the same time prevents the rolls bumping a hole in the board. The knock-off pin of the rod can be adjusted for any hight dies by simply running it up or down the rod. This makes one adjustment for the lower trip position. The hight of fall is regulated by the position of the upper dog, and this can also be adjusted anywhere up or down the front rod. The front rod is almost straight. This is a comparatively new feature as heretofore this type of machine has had a long double bend which often resulted in breakage.

These machines are built in sizes from 1000 to 3000 pounds inclusive. Above 2000 pounds they are built with cast-steel bases, cast-steel lifter frames, and extra-heavy cast-iron uprights. This machine is built by the United Engineering and Foundry Company, Farmers Bank building, Pittsburg, Penn.



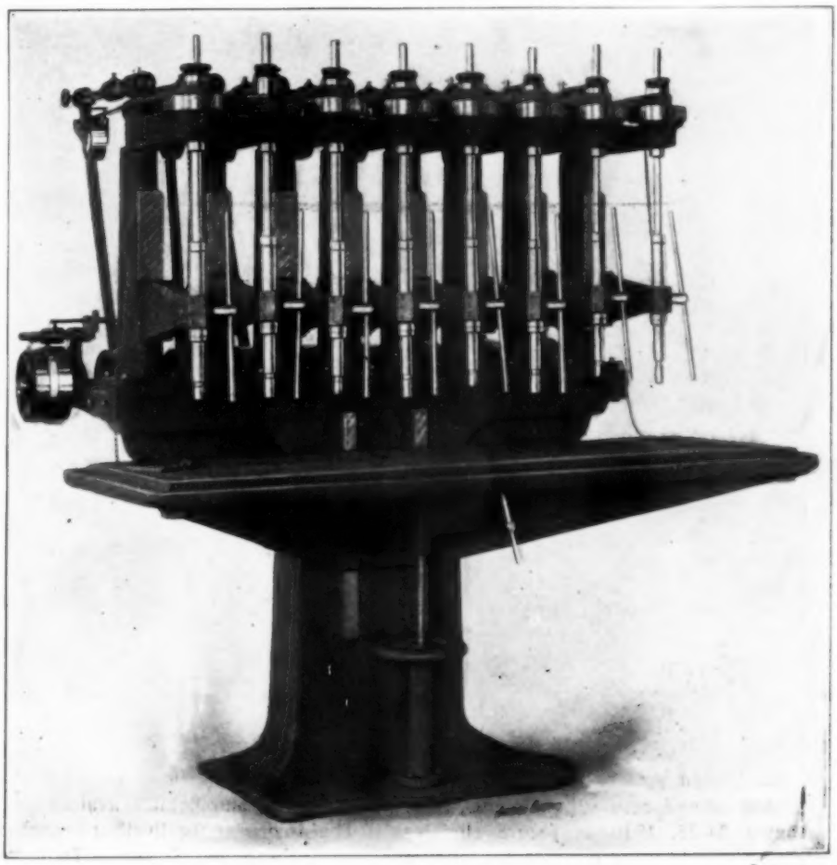
A Drop Press

ANY and all new or improved machines, tools, or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here—the machine shop news.

A more full and detailed description will be given—when it is real news—if it can appear here first—before it is sent to other papers. All descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German.

An 8-Spindle Drilling Machine

The halftone shows the 1910 model ball-bearing drilling machine, built by Henry & Wright Manufacturing Com-



An 8-spindle Drilling Machine

pany, Hartford, Conn. In this machine the base has been increased in width and weight, as has also the table, the oilgrooves of which have been doubled in width and depth.

The idler pulleys have also been redesigned and run on larger bearings than formerly.

The new model is built in forty-eight different styles, with from one to eight spindles, and arms providing an overhang of 7, 9½, 12 and 15 inches, with tables to match.

A Large Double Vertical Press

The halftone shows a large double vertical press built by Ernest Schiess A. G., Düsseldorf, Germany. This press is capable of exerting a pressure of 1,000,000 kilograms — approximately 2,200,000 pounds.

The housing is made of gray iron, in halves, keyed and shrunk together with steel links. Both inside and out- the castings are heavily ribbed. The rectangular bosses in front and just below the large gear wheel are fitting pieces to which the working platform is attached.

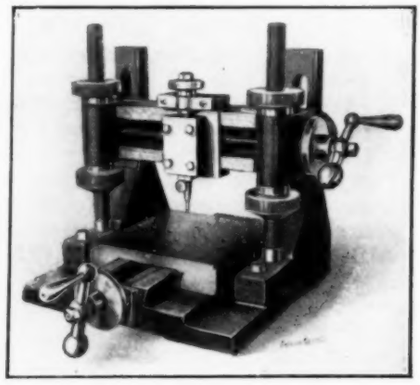
Although the cast frame is capable of withstanding any strain that may be put upon the press, heavy steel bolts reach from top to bottom just behind the gap where the greatest strain occurs.

The shafts, connecting rods, cams, gears and all parts subject to excessive strains are of steel forgings or castings. Peep holes are provided at suitable points so that the action of the various parts may be readily observed while in operation. The cast-steel rams are counterbalanced, and make about 16 strokes per minute. The length of stroke is 180 millimeters, equal to about 7¼ inches. Power is supplied by a 120-horsepower motor. The machine complete weighs 160,000 kilograms—about 336,000 pounds.

The Richards' Accurate Locating Machine

The halftone shows a 6-inch locating machine for accurately locating centers on dies, jigs, templets, in fact any condition where accurate locating is desirable.

The table, cross and vertical slides are accurately fitted and well gibbed. The screws are accurately cut and fitted to taper nuts to take up wear. Index dial is graduated to read to 0.001 inch.



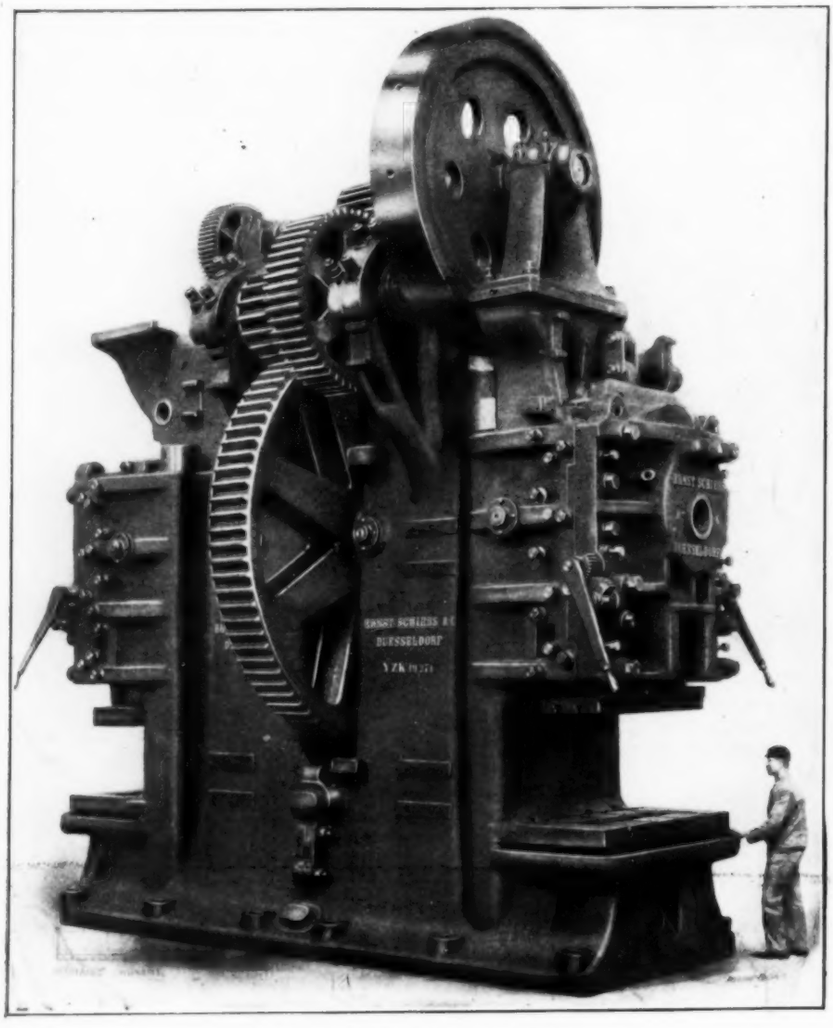
THE RICHARDS ACCURATE LOCATING MACHINE

This machine is especially designed to enable the operator to locate points with accuracy as well as with rapidity by means of cross-scribed lines.

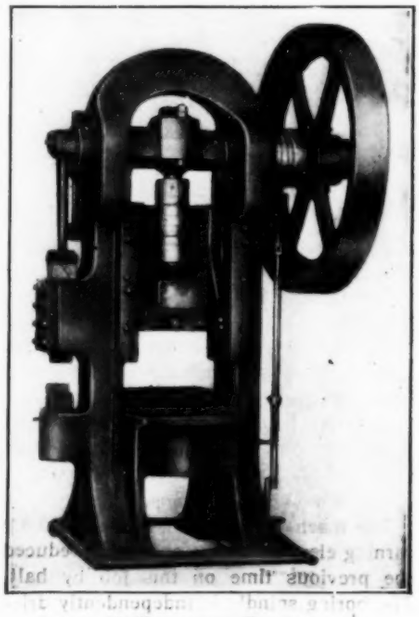
The machines are made in three sizes. The No. 1 will take a block up to 4 inches square and the No. 3 will take a block up to 12x14 by 8 inches high. They are built by the Beacon Tool Works, Naugatuck, Conn.

A Trimming Press

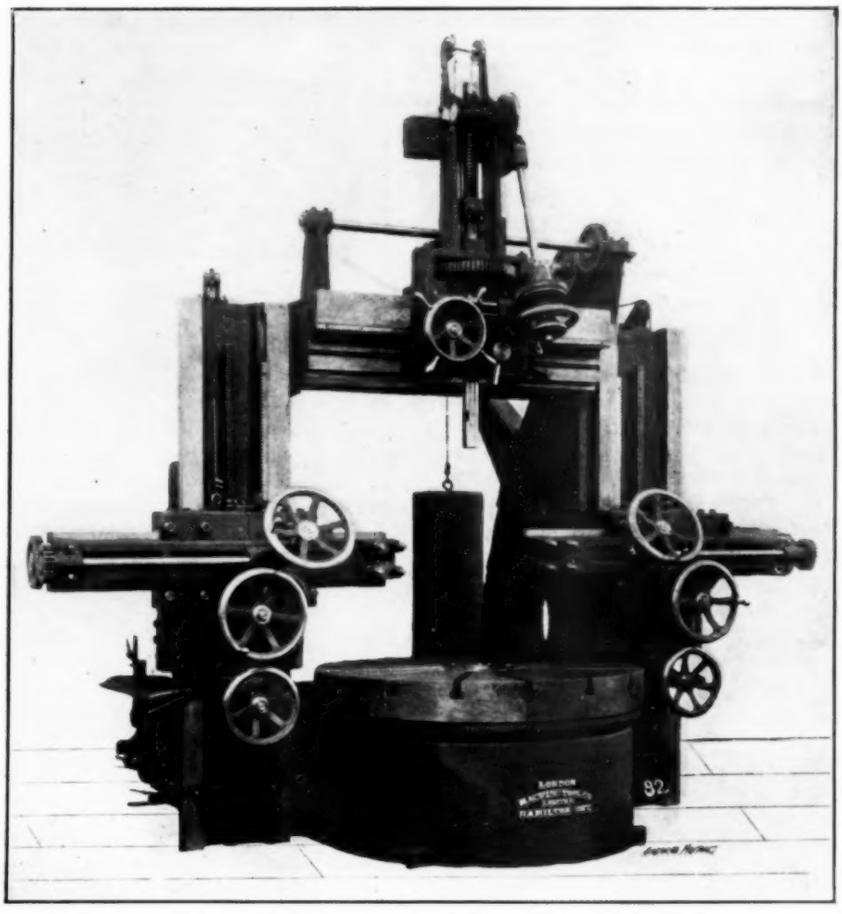
The halftone shows one of a line of trimming presses built in four sizes by the United Engineering and Foundry Company, Pittsburg, Penn., which carry respectively 5-, 6-, 7½- and 9-inch shafts. These machines are designed to carry



A LARGE DOUBLE VERTICAL PRESS



A TRIMMING PRESS



A 60-INCH VERTICAL BORING MILL

extra-long bed and slide, extra-heavy side cutoff attachment, and are made with forged-steel connections throughout. The main frame is bronze bushed and the machines are all supplied with steel jaw clutches.

A distinctive feature about these machines is that the clutch mechanism is symmetrical around the center line and the treadle can be reversed front to back, making either a right- or left-hand machine as desired. The extra holes are always bored so that the customer can make this change at any time. The presses are built either geared or with flywheel as desired.

A 60-inch Vertical Boring Mill

The halftone shows a boring mill recently built by the London Machine Tool Company, Ltd., Hamilton, Canada.

The general outline of this machine is due to Robert Wilson, superintendent of the Otis-Fensom Elevator Company, for which concern it was built.

The machine is especially designed for turning elevator drums and it has reduced the previous time on this job by half. The boring spindle is independently driven by a 3-horsepower, variable-speed motor, which makes the spindle entirely independent of the table.

The table is driven by a 20-horsepower variable-speed motor and is provided with an electrical brake, which stops the machine instantly at any point.

The heads are adjustable on the housings independently of the screws, so that the tool may be located in the groove before throwing in the feed.

A Quick-acting Wrench

The wrench shown will turn a square, hexagon, flat or round-shaped piece which has a slight resistance in the direction of rotation desired, without removing it from the piece.

The action is positive and will not slip.

The shank *A* is slotted, the stock *C* is pivoted to it at *E* and is free to move in the slot except when the locking bolt *D* is pushed under the yoke *H*, in which case the wrench can be used in every way the same as the regular monkey wrench with the added advantage of having a slight friction due to the spring *I* in the adjusting screw *F* which tends to keep it set to the size it is adjusted for.

When used as an automatic wrench the locking bolt is pushed back into the stock as shown in Fig. 2 and the wrench adjusted to size on the piece to be turned.

The action of the wrench when it is pushed backward for a new grip is as follows: First for the shank *C* to lift away

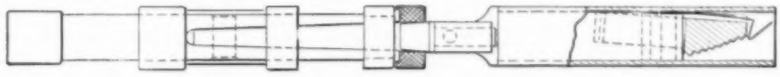


FIG. 1

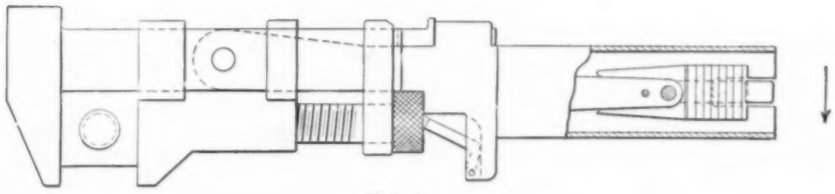


FIG. 2

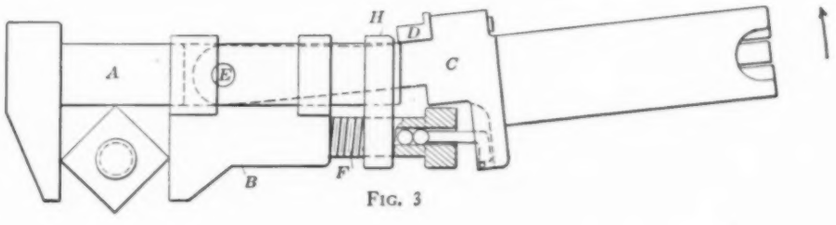
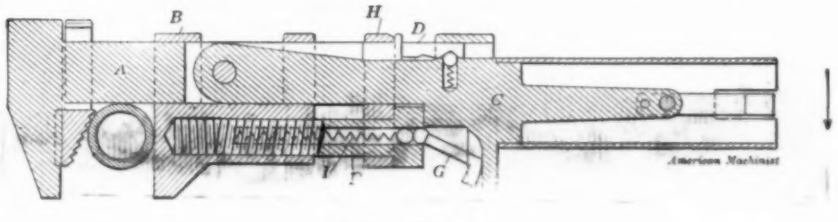


FIG. 3



A NEW WRENCH

from the adjusting screw *F*, then for the sliding jaw to open over the corners of the nut, then to close in again on the next flats of the next due to the tension of the spring *I* in the adjusting screw *F*.

When the wrench is pulled forward against the shank it engages the adjusting screw *F* and is ready for another pull.

The curved surface of the spring rod *G*, which rolls on the bottom of the groove in the shank *C*, is shaped to give a slight pressure tending to close the wrench.

A detachable pipe jaw fits loosely over the jaw of the wrench and is held from falling off by the hook-shaped arms as shown. The object of this jaw is to slip freely on the face of the wrench jaw when in use and wedge itself into the pipe or other object being turned, this forming a three-point bearing on the object and giving a grip that is sure to hold but which will release itself easily and catches readily for a new grip.

The pipe jaw is very neatly secured in the hollow handle by the spring as shown when not in use.

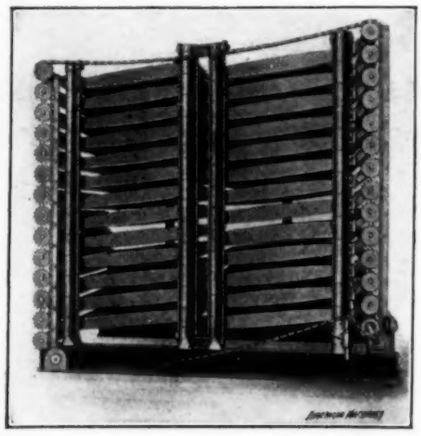
The wrench is designed and patent applied for by George W. Jessup, Jr., Newton, Mass.

A Chain Drive for Dryers

The halftone shows a driving method for the series of parallel shafts or rolls for drying textiles, etc. This drive is said to be much more efficient than were the trains of spur gears, and the bevel-gear drives formerly used.

The drive has a set of rolls for each tray, the drying unit varying in size from six on the smallest up to forty trays on largest machines. A single loop of 1½-inch pitch Diamond Roller Chain made by the Diamond Chain and Manufacturing Company, Indianapolis, Ind., runs around the machine and meshes with a sprocket on each roll.

The lowest right-hand roll sprocket is the driver on the machine shown and turns clockwise. The chain is kept in contact with the sprockets by means of two steel guide rails, one on each side of the machine. These rails being slightly narrower than the width of the chain rollers, compel the chain to mesh with the sprockets. The lower strand of the chain runs loose and at the left of the driving sprocket an idler is provided which is adjustable vertically to take up the slack.



A CHAIN DRIVE FOR DRYERS

Adjustable Reaming Tool for Turret

By J. Scott

Fig. 1 shows a special adjustable turret reamer that is used to clean out the hole *A* in the brass casting, Fig. 2, in place of grinding. This tool was required on account of the slot *B*, Fig. 2; when a regular reamer was used it left a high spot on the opposite side. A single-tool boring bar was also used but this proved rather slow.

When the reamer is entered into the bore *A* the part *C*, Fig. 1 forms a bearing on the opposite side, steadying the cutter *D* which then gives a smooth hole. The piece of felt shown at the rear of the cutter keeps the chips from getting between support *C* and the casting. The felt strip is fastened to the reamer body by two screws, not shown.

This style of reamer is in constant operation daily as we have three different sizes of castings with 2-, 3- and 4-inch holes.

Fig. 1 shows the 3-inch reamer assembled and in detail. *C* is a semi-circular hardened-steel bearing piece, *E* is a large collar fastened by screw *F* to the reamer body to steady the cutter at end *G* which smooths up the mouth of the casting. The cutter *D* is of high-speed steel. The pins *I* and *J* bear on taper adjusting pin *K*. Section *A*, Fig. 1, is simply shown to illustrate slots *L M* for the cutter and felt.

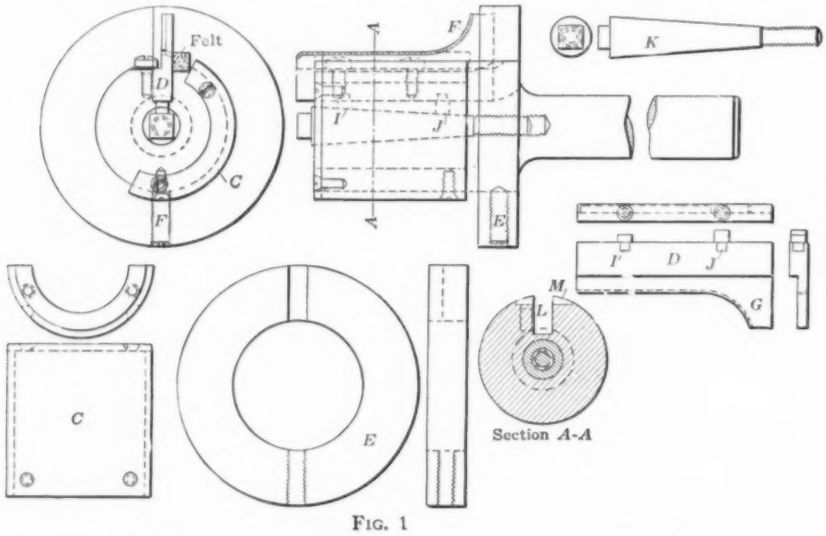


FIG. 1

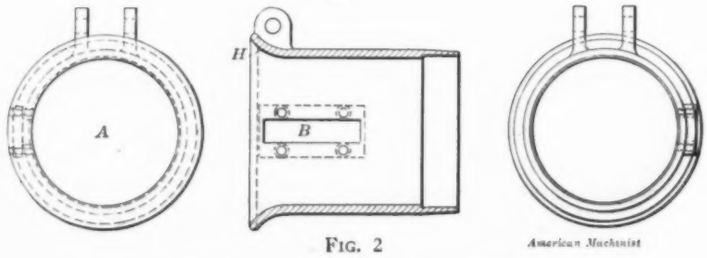


FIG. 2

DETAILS OF REAMER FOR THE TURRET

The scientists have taken another guess at the age of mother earth, the latest figures crediting her with "not above 70,000,000 years or below 55,000,000." This estimate, given the official sanction of the Smithsonian Institution, is the result of studies by F. W. Clarke and G. F. Becker, of the United States Geological Survey. The margin of uncertainty of 15,000,000 years is believed to be sufficient to keep "mother" from being offended at our inquisitiveness. This seems to be even more indeterminate than the proverbial "how old is Ann" problem.

Increasing Shop Capacities

Metal Working

The Walden (N. Y.) Knife Company will enlarge its plant.

S. D. Vivant, Wahkon, Minn., will build a new blacksmith shop.

The Wisqually Iron Works, Tacoma, Wash., will build a new plant.

The Red Foundry at St. Thomas, Canada, is building large additions.

The Gareau Motor Car Company will build a large factory at Montreal.

The Virginian Railway will erect a $30,000 repair shop at Roanoke, Va.

The Bonner Wrench Company, Chrisman, Ill., is looking for a new site.

The Begsley Blacksmith Company will erect a building at Bemidji, Minn.

The International Harvester Company will extend its plant in London, Canada.

The new Stratman Vehicle Company, Dodgeville, Wis., will have a new factory.

The new $500,000 factory of the Ringen Stove Company is now being erected.

The Montreal Street Railway is equipping extensive new car shops at Montreal.

Tudhope & Lindsay will establish a large wagon works at Port Arthur, Ontario.

The Prince Rupert Sheet Metal Works will build a factory at Prince Rupert, B. C.

Elkhart (Ind.) Motor Car Company is looking for a site on which to build a plant.

Work has been started on the new plant of the Pontiac (Mich.) Foundry Company.

The Pilot Motor Car Company, Richmond, Ind., is looking for a site to build a factory.

The Canadian Railway Signal Company are building a $100,000 factory at Lachine, Quebec.

Calgary Street Railway will spend $250,000 for new equipment and extensions to the system.

The Dayton Motor Car Company, Dayton, Ohio, are building a one- and two-story factory.

The Hale Motor Machinery Company has bought a factory on Franklin street, Detroit, Mich.

It is rumored that the Mason-Maytag Auto Company, Waterloo, Ia., will build a new plant.

The Auto Car Company, Ardmore, Penn., is looking for a site on which to erect a new plant.

The Wileg Foundry and Machine Shop will be moved from Temple to San Angelo, Texas.

The Kootenay Engineering Works, at Nelson, B. C., was destroyed by fire. Loss, $20,000.

The plant of the Cincinnati (Ohio) Ball Crank Company was damaged by fire on July 23.

The K. C. Southern Railway Company will build a shop at Shreveport, La., to cost about $500,000.

The Juel Brothers Manufacturing Company will erect a garage and machine shop at Canton, S. D.

The machine shop and foundry of Bellefueille & Frere was destroyed by fire, July 21. Loss, $10,000.

W. Whelpley, of Greenwich, New Brunswick, Canada, will build a skate factory at Moncton, N. B.

News items for the sales department—where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip—facts.

The Sawyer Massey Company, of Hamilton, Canada, will establish a big western branch at Regina, Sask.

The plant of the Neely Nut and Bolt Works, Pittsburg, Penn., was burned July 22. Loss, $25,000.

The Lockwood & Strickland Company's Chicago woodworking plant was burned July 20. Loss, $100,000.

The West Manufacturing Company, of London, Ohio, will make an addition to its factory to cost $10,000.

Land has been purchased for an addition to the plant of the Keystone Steel and Wire Company, Peoria, Ill.

The American Brake Company will erect a new shop at 1920 North Broadway, St. Louis, Mo., to cost $20,000.

Albia, Ia., is to have a new machine shop and factory to cost $20,000. John Z. Evans is back of the factory.

Case Brothers, Kane, Penn., are looking for a site on which to build a branch cutlery factory in New England.

The Canadian Northern Railway Company will erect a roundhouse and machine shop at West Duluth, Minn.

Fire totally destroyed the plant of the Pittsburg Manufacturing Company, Pittsburg, Penn. It will be rebuilt.

The Ross Gear and Tool Company, Lafayette, Ind., has increased its capital stock from $50,000 to $100,000.

The Greenberg Iron Company, Terre Haute, Ind., proposes to build a new plant. A rolling mill will also be built.

The Stewart Aerial Vehicle Company are having a factory built at East Oakland, Cal., to manufacture aëroplanes.

Orders for 150 electric motors will soon be placed by the Bryant Paper Mill (Dan J. Albertson), Kalamazoo, Mich.

The Baldwin Forging and Tool Company, of Columbus, Ohio, will move and erect new works at Parkersburg, W. Va.

The Collins Axle Manufacturing Company, Pittsburg, Penn., will erect a plant for making automobile transmissions.

Fire destroyed the office and buildings of the Damascus Brake Beam Company, of Sharon, Penn. Loss, $125,000.

The Sharon Steel Hoop Company, of Sharon, Penn., has authorized the construction of a new band mill to cost $200,000.

The Mead Motor Company, of Dayton, Ohio, is receiving bids on a new brick fatcory building to cost about $100,000.

The Vulcan Steam Shovel Company, Toledo, Ohio, is having plans prepared for a $200,000 plant at Evansville, Ind.

American Gas Machine Company, Albert Lea, Minn., are looking for a site in the East on which to build a branch factory.

A branch factory to cost about $100,000 will be built at Chicago by the Sharples Separator Company, Westchester, Penn.

Fire destroyed the plant of Wames & Co., Jersey City, N. J., manufacturers of spikes and bolts, on July 23. Loss, $25,000.

The erection of the factory of the Sperdule Automobile Company, Fracksville, Penn., will be started in the next few weeks.

Contractor C. A. Fellows has taken out a permit for the Santa Fe machine shops, the permit calling for an expenditure of $130,000.

The Mann Indicator Manufacturing Company, with offices in Pittsburg, has resumed operations after a suspension of several years.

Plans have been completed for the $250,000 addition to the Missouri Pacific Railway Company's machine shops at Kansas City, Mo.

Work has been begun on the new main mill building planned at the works of the Youngstown (Ohio) Iron and Steel Roofing Company.

The Premier Motor Manufacturing Company, Indianapolis, Ind., is building additions which will almost double the capacity of its plant.

The Clinton (Mass.) Wire Cloth Company has acquired four and one-half acres of land suitable for an enlargement to its present plant.

The Thomas Steel Company, Niles, Ohio, will erect a new building to be used as a stock room. The improvement will cost $50,000.

The Fairmount Mining Machinery Company, of Fairmount, W. Va., will purchase new equipment for its machine shop, amounting to $25,000.

Geo. Whiting Company, 1413 West North avenue, Chicago, manufacturing punches and shears, will build a new shop to cost about $30,000.

On July 25 fire destroyed the plants of Durand Steel Locker Company, and Thomas Brass and Iron Works, Waukeegan, Ill. Loss, $100,000.

International Harvester Company, Milwaukee, Wis., Fourteenth avenue and Park street, will build a foundry to cost about $400,000.

Fire at the plant of the Pullman Company, Pullman, Ill., July 17, destroyed the power plant and freight-car shops. Loss, about $300,000.

Plans have been completed for the new building for the woodworking and electrical departments of the Otis Elevator Company, Quincy, Ill.

Contracts have been awarded for the new building for the Union Drawn Steel Company, Beaver Falls, Penn. This plant was recently destroyed by fire.

A large addition is being made to the foundry of the Roll and Machine Works of the American Sheet and Tin Plate Comany, at Canton, Ohio.

The new $100,000 factory of the Victor Automobile Manufacturing Company, at Boyle avenue and Pacific street, St. Louis, Mo., will be started at once.

The Lapointe Machine Tool Company, Hudson, Mass., is to enlarge its plant by building an addition to the main factory, which will be three stories high.

The Southern Manufacturing Company, Columbus, Miss. (capital $75,000), will put in operation the plant operated several years ago by the New South Plow Works.

The Temple (Texas) Machine and Foundry Company will move to Cleburne, Texas. It is said that this company has a large contract with the Santa Fe Railroad for castings.

Plans for a three-story factory building, combining machine shops, foundry and planing mill to be erected by the Smalley Manufacturing Company, Manitowoc, Wis., are in preparation.

O. H. Crittenden, of Palestine, chief engineer of the International and Great Northern Railroad, is laying off the site for the three new solid steel and concrete shop buildings, at Taylor, Tex.

The Globe Foundry and Machine Company, Sheboygan, Wis., located at the corner of Seventh street and Penn avenue, suffered a fire loss. The damage is estimated at from $5000 to $7000.

Jos. Cody & Sons, Peoria, Ill., manufacturers of boilers, tanks, etc., has leased the vacant plant of the Bradford Car and Manufacturing Company, at Bradford, Ill., and will remove to that place.

An addition of seven stalls to the roundhouse is contemplated by the M. & St. L. among other improvements being made at Fort Dodge, Iowa. New machine shops also are to be built by the company .

It is reported that the Louisville & Nashville Railroad Company has purchased a large tract of land near the New Decatur (Ala.) shops and that it will erect shops thereon for the building of steel freight cars.

Construction of a $200,000 plant for the Griffin Car Wheel Company, Chicago, Ill., will be begun about September 1 at Fifty-fourth street and Santa Fe avenue, Los Angeles, Cal. Carwheels and underbodies will be manufactured.

Following the announcement by the United States Motor Company that a Detroit plant would be built for the making of Sampson trucks, a building 1050x150 feet is in process of construction near the plant of the Brush Runabout Company.

The Stewart Stamping Company has been taken over by the United States Stamping Company, of Moundsville, W. Va. The two plants are adjoining, and are being operated as one, under the management of J. M. Sanders, president of the United Stamping Company.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open the following bids: August 9—4 auto starters, 150 insulators (schedule 2744), 15,000 lb. steel bolts (schedule 2758), 270 lb. copper burrs and rivets, miscellaneous hardware, 10,400 lb. steel rivets, 237 gross machine screws, 880 gross wood screws (schedule 2752), pipe and valves (schedule 2757), 1 blueprinting machine (schedule 2739), 1 punch and shear, 1 planing and jointing machine, 1 chain saw mortiser, 1 drop table molder (schedule 2740), 1 sensitive drill press (schedule 2741).

General Manufacturing

Montreal South will install a new waterworks system.

Princeton, B. C., will spend $25,000 extending its waterworks.

Revelstoke, B. C., will spend $30,000 for a new waterworks.

The Minagret Mills, Mystic, Conn., will install additional looms.

The Knight Mill, at Lippitt, R. I., will make extensive improvements.

Berlin, Ontario, will purchase compound duplex pumping engines.

Seaforth, Ont., will spend $25,000 extending its electric-lighting plant.

The Wilson Stationery Company are equipping a large factory in Winnipeg.

Sydney, Nova Scotia, will spend $10,000 on extensions to its waterworks plant.

The Grafton Colony for the Insane, Grafton, Mas., will install a new boiler.

R. E. Schurz, of Alamagordo, N. M., will build a gas plant at Taylor, Texas.

Toronto, Canada, will buy a large quantity of water meters and supplies shortly.

A municipal electric-light and filtering system will be installed at Durant, Okla.

The Longport (N. J.) Electric and Water Company will build a new power plant.

Stafford mill No. 1, Fall River, Mass., will install a new 1500-horsepower engine.

The Continental Bag and Paper Company are building a $30,000 factory at Ottawa.

The Seymour Iron Foundry, Seymour, Conn., are in the market for a steam engine.

On July 18 fire destroyed the grease plant of the Standard Oil Works, at Whiting, Ind.

The Dorrallton Hat Manufacturing Company will start a factory at Fall River, Mass.

The Cranbrook Sash and Door Company will equip a $100,000 plant at Cranbrook, B. C.

Winnipeg City, Can., will buy 46,000 feet of 13,000-volt 3-score cable before September 1.

The St. Lawrence Brick Company will spend $300,000 on a new plant at La Prairie, Quebec.

The factory of the Inter Ocean Shirt Company, Bellows Falls, Vt., will be started shortly.

The French River Textile Company, Mechanicsville, Conn., will install additional machinery.

The Thames Specialty Company, Uncasville, Conn., will install paper-making machinery.

Yonkers, N. Y., is considering the erection of a new and larger municipal garbage crematory.

The Bryant McLaughlin Asphalt Company, Waterloo, Ia., has been burned. Loss, $10,000.

The Kreyscher Shingle Mill, Nelson, B. C., Canada, has been damaged by fire. Loss, $30,000.

The planing mill of the Heineman (Wis.) Lumber Company was destroyed by fire July 22.

The National Woodenware Company, Hill City, Minn., will erect five new factory buildings.

Moosejaw (Can.) Electric Railway will spend $400,000 for equipment and new power houses, etc.

Aberdeen Sash and Blind Factory, Aberdeen, N. C., was destroyed by fire July 17. Loss, $50,000.

Contract has been let by Caldwell & Watson, Fostoria, Ohio, for the reconstruction of their plant.

Fire destroyed the factory of the Chippewa Falls Chair Company, Chippewa Falls, Wis. Loss, $25,000.

Bids have been asked for on large additions to the Portsmouth, N. H., plant of the Morley Button Company.

The power plant of the Kennon Coal Company, Cleveland, Ohio, has been destroyed by fire. Loss, $40,000.

The plant of the Victoriaville Chair Factory, at Montreal, was completely destroyed by fire. Loss, $20,000.

The Flour City Fuel and Transfer Company, of Minneapolis, Minn., will erect a $3500 blacksmith shop.

The Leighton Machine Company, of Manchester, N. H., is in the market for a 50-horsepower steam engine.

The Rockford Knitting Company, Philadelphia, Penn., will build a new factory. Estimated cost, $150,000.

Plans have been completed for the construction of factory No. 2 of the Globe Furniture Company, Evansville, Ind.

Plans are being prepared for a three-story addition to the plant of the Whipple & Chote Company, Bridgeport, Conn.

The United Illuminating Company, of Bridgeport, Conn., is making additions to its power-house equipment.

The Whitaker-Glessner Company, Wheeling, W. Va., will build a new steel plant at Yorkville, Ohio, opposite Wheeling.

The D. W. Felch Chair Company, Keene, N. H., will require a boiler for the dryer house at the Williams factory.

The shingle mill of the Cowlitz Shingle Company, Castle Rock, Wash., was destroyed by fire July 16. Loss, $20,000.

Marx & Rowalle will establish a $25,000 factory at Montreal to manufacture shellac, varnish and similar preparations.

A. H. Caplan & Co. are building a large babbitt-metal and solder foundry at Ottawa, and a smelting and refining plant.

The Paul Lea Woodworking Company, of Moncton, New Brunswick, will establish a branch plant at Campbellton, N. B.

The Salisbury (N. C.) Cotton Mills will build an addition to its weaving department. It will be equipped with 80 looms.

Fire destroyed the tank room and contents at the works of the National Conduit and Cable Company, at Hastings, N. Y.

Westbrook & Hackers brewery, at Brantford, Can., which was damaged to the extent of $50,000 by fire, will be equipped.

Work will be started at once on the construction of a large carbon works at Niagara Falls for the National Carbon Company.

The woodenware factory of Freeman Manufacturing Company, Kalkaska, Mich., was destroyed by fire July 20. Loss, $50,000.

The Miller Tanning and Extract Company's factory at Mortimore, New Brunswick, Can., was damaged by fire to the extent of $20,000.

The Shaver Carriage Company, Des Moines, Iowa, will soon begin the erection of a three-story addition to its factory to cost $20,000.

Up-To-Date Laundry Company, Cleveland, Ohio, will build an addition. Will install electric power and additional laundry machinery.

A power plant which, when completed, will have cost $40,000, is being erected by the Sloss-Sheffield Steel and Iron Company, at Sloss, Ala.

The Kansas Gas and Electric Company, Wichita, Kas., H. S. Bladen, manager, will commence work on its $600,000 power plant this month.

The Brunswick-Balk-Collender Company, Los Angeles, Cal., makers of billiard balls and tables, will erect a new factory to cost about $40,000.

The Aluminum Company of America, New Kensington, Penn., is erecting two new buildings, one to be used as an erecting room and the other as a warehouse.

The Newburgh (N. Y.) Light, Heat and Power Company plans to extend its lines in Ulster county and to erect two substations. Approximate cost, $70,000.

The Huntington Wagon Works, Huntington, Ind., has let a contract for the erection

of two additional buildings to be used as a paint shop and a blacksmith shop.

A fruit and vegetable-canning company has been incorporated in Cuba, Ala. J. W. Walker, W. E. McGowan and A. J. McElroy are the building committee and will purchase all machinery.

The Berlin Machine Works, of Beloit, Wis., manufacturer of woodworking and sawmill machinery, is contemplating erecting in or near Seattle a plant to handle its business on the Pacific coast.

Preparatory to the erection of a permanent factory in Paducah, Ky., the Mutual Wheel Company, of Moline, Ill., has purchased a piece of property in Mechanicsburg and the work of erecting the buildings will be started at once.

According to an announcement made by a local Missouri Pacific official, at Kansas City, Mo., the plans for the addition to the company's machine shops in the East Bottoms, have been completed and work will be commenced within a few days. The railroad company will spend $250,000 for this improvement, which will nearly double the size and capacity of this institution.

The steady and continued growth in the distribution of Premier motor cars has influenced the Premier Motor Manufacturing Company, of Indianapolis, Ind., to enlarge the capacity of its factory at Georgia and Shelby streets, and already operations are under way which will almost double the present floor space and proportionately increase the production. The Premier company has purchased additional ground in Georgia street opposite the present plant.

It is reported that the following companies will be consolidated: McGregor, Gourley Company, Ltd., Galt, Can.; the John Ballantine & Co., Ltd., Preston, Can.; the Hespeler Machinery Company, Hespeler, Can., and the woodworking machinery departments of Goldie & McCulloch Co., Ltd., Galt, Can., and the Sussex Manufacturing Company, Sussex, N. B., Canada. The new company will be known as the Canada Machinery Corporation, Ltd., with headquarters at Galt. Capital, $4,000,000.

New Incorporations

Haskins Boiler Company, New York City. Capital, $50,000.

Albany (N. Y.) Lock and Seal Company. Capital, $50,000.

The Auto Aero Supply Company, White Plains, N. Y. Capital, $5000.

Mackey Water Motor Pump Company, Silver Creek, N. Y. Capital, $50,000.

Hotz Foundry and Manufacturing Company, Sandusky, Ohio. Capital, $25,000.

The Shepherd Automatic Switch Company, Montgomery, Ala. Capital, $100,000.

Fennia Manufacturing Company, Hancock, Minn. Dial levels. Capital, $50,000.

The Copley Textile Manufacturing Company, Philadelphia, Penn. Capital, $10,000.

Automatic Feed Regulator and Specialty Company, Kittery, Me. Capital, $200,000.

The Sapphire Record and Talking Machine Company, 50 Church street, New York. Capital, $100,000.

Cleveland (Ohio) Motor Truck Company. Capital, $250,000. Incorporators, W. B. Stewart and others.

The Forth Motor Car Company, Mansfield, Ohio. Capital, $200,000. Incorporators, C. S. Ashbrook and others.

Nisqually Iron Works, Tacoma, Wash. Capital, $25,000. Incorporators, John Bagley, J. C. Dickson and others.

Bradley Iron Works, Milwaukee. Capital, $25,000. Incorporators, J. A. Wallis, Aug. Moeller and H. C. Mullen.

Nisqually Iron Works, Tacoma, Wash. Capital, $25,000. Incorporators, John Bagley, J. C. Dickson, and others.

Auto Renewal Company, Chicago, Ill. Capital, $2500. Incorporators, J. S. McClellan, Leo Klein, J. J. Cermak.

L. B. B. Faucet Company, Springfield, Mass. Capital, $60,000. President, Moses La Loude; treasurer, A. J. Brunnelle.

National Piano Company, Portland, Me. Capital, $300,000. President and treasurer, J. A. Mahoney, Boston, Mass.

Hall's Patent Tool Company, St. Louis, Mo. Capital, $50,000. Incorporators, Jas. G. Hall, Jos. A. Sauls, Philip Wagner.

Ritter Automobile Company, Madison, Wis. Capital, $25,000. Incorporators, H. R. Ritter, J. C. Harper and H. E. Webster.

Never-Break Wrench Company, St. Louis, Mo. Capital, $2000. Incorporators, A. V. Oge, Adolph Nerrhoff, S. F. Raab.

Antlers Light and Power Company, Antlers, Okla. Capital, $10,000. Incorporators, J. Eaton, Clark Wasson, and others.

Rayfield Motor Car Company, Springfield, Ill. Capital, $150,000. Incorporators, J. F. Miller, E. E. Staley, Burke Vancil.

Peerless Machine Company, Chicago, Ill. Capital, $10,000. Incorporators, Geo. N. Morgan, Jared W. Houng, Wm. F. Kuehl.

Leominster Garage and Auto Company, Leominster, Mass. Capital, $5000. President, Leo M. Stutz; treasurer, Morris Falk.

Pennsylvania Motor Car Company, Wilmington, Del. Capital, $200,000. Incorporators, C. L. Hearn, V. Atkinson, J. M. Frere.

Empire Iron Mining and Manufacturing Company, Spokane, Wash. Capital, $300,000. Incorporators, D. F. Shobeck, C. Abrams.

Standard Die Cutting Company, Detroit, Mich. Capital, $25,000. Incorporators, Charles F. Springman and F. J. Mamer.

Cochrane Pipe Wrench Company, Chicago. Capital, $100,000. Incorporators, F. E. Hinckley, J. W. Cochrane, W. W. Taylor.

The Redkey Electric Light Company, Muncie, Ind. Capital, $10,000. Incorporators, F. B. Ball, R. E. Breed and H. L. Finley.

Woodward (Okla.) Canning and Manufacturing Company. Capital, $20,000. Directors, D. B. Lanne, Wm. Peterson, J. W. Hamilton.

Farmers' Motor Wagon and Plow Company, Oklahoma City, Okla. Capital, $100,000. Incorporated by C. Moulton, D. East and others.

Tebbetts Garage and Manufacturing Company, Malden, Mass. Capital, $25,000. President, F. P. Miller; treasurer, C. E. Tebbetts.

Western Horseshoe Manufacturing Company, Seattle, Wash. Capital, $100,000. Incorporators, J. A. Moore, Herbert E. Law, and others.

The Garver-Tracey Laying Machine Company, Urbana, Ill. Capital, $50,000. Incorporators, T. M. Garver, of Champaign, and others.

Perfection Check Protector Company, Wilmington, Del. Capital, $50,000. Incorporators, F. M. Shivoe, S. E. Robertson, and H. M. Davis.

The Pay-As-You-Enter Car Corporation, Wilmington, Del. Capital, $5,000,000. Incorporators, Chas. F. Fox, Wm. G. Taylor, H. W. Davis.

The Peerless Wire Goods Company, Lafayette, Ind. Capital, $10,000. Incorporators, Elbert Jackson, H. R. Clegg and Ernest Schilling.

Central Steel Company, Ottawa, Ill. Capital, $10,000. A general foundry business. Incorporators, Fred L. Fischer, L. P. Fischer, and others.

Automatic Deep Well Pump Company, Dover, Del. Capital, $50,000. Incorporators, W. F. P. Lofland, W. I. N. Lofland, J. S. Collins, Jr.

Lawson Manufacturing Company, Chicago, Ill. Hardware specialties. Capital, $25,000. Incorporators, W. J. Gold, O. Katzeberger, E. E. Pettle.

The Peerless Motor Car Company, of Illinois, Chicago, Ill. Capital, $60,000. Incorporators, Louis E. Hart, Jaspersen Smith, D. T. McNabb.

The Mechanical Equipment Company, Montreal. Boilers and equipment. Capital, $50,000. Incorporators, Stephen Davis and Jos. Presner, Montreal.

American Spark Arrester Company, Indianapolis, Ind. Capital, $100,000. Directors, T. A. Van Horn, Chas. A. McCatter, H. N. Knight and others.

Stephens-Cropley Company, Chicago, Ill. Engines and machinery. Capital, $25,000. Incorporators, Geo. W. Stephens, F. S. Cropley and Wm. A. Conover.

Stevens Manufacturing Company, Rome, N. Y. Carbureters and motor supplies. Capital, $50,000. Incorporators, S. B. Stevens, and A. L. McAdam.

Saylor Generator Grate and Stoker Company, Boston, Mass. Capital, $100,000. President, F. G. Saylor; treasurer, C. W. Adams, Quincy, Mass.

Chicago (Ill.) Auto Clock Company. Capital, $50,000. Incorporators, A. L. Benner, Wm. M. Lawton, Otto G. Knecht, 504 Chamber of Commerce, Chicago.

Hyde Park (Mass.) Steel Castings Company. Capital, $25,000. President, S. J. Coleman, Dedham, Mass.; treasurer, W. M. Murray, Hyde Park, Mass.

Junkers-Burdick Company, Chicago, Ill. Manufacture automobiles and accessories. Capital, $25,000. Incorporators, Otto Junkers, Winthrop Burdick, G. J. Meier.

United Stove and Repair Company, Brooklyn, N. Y. Manufacture stoves and stove parts. Capital, $50,000. Incorporators, A. Meurer, C. H. Bolles, and others.

The Stahlbrodt Company, Rochester, N. Y. Wind shields for automobiles and aeroplanes. Capital, $25,000. Directors, L. C. Stahlbrodt, A. M. Brewer, R. B. Griffin.

Lawrence M. Stein Company, Chicago, Ill. Manufacture machinery and supplies. Capital, $12,000. Incorporators, C. B. Stafford, T. C. Kennedy, W. R. Leeper.

The La Marr Aero Company, Frankfort, Ky. Manufacture the La Marr biplane. Capital, $50,000. W. B. Adams, president; Perry Gable, secretary; Fay Cress, treasurer.

Athey Sanitary Equipment Company, Chicago, Ill. Manufacture window and door equipments, etc. Capital, $50,000. Incorporators, E. D. Weary, I. H. Athey, W. H. Alford, etc.

The Simms Magneto Company. Capital, $1,000,000. Incorporators, Victor D. Hecht, Horace M. Kelbarn, Alfred Nathan, C. S. Guggenheimer, Mortimer Stiefel, all of New York City.

Universal Car Seal and Appliance Company, Albany, N. Y. Manufacture car seals, etc. Capital, $60,000. Incorporators, Howard Van Rensselaer, Wm. C. Martineau, Clarence R. Martineau.

American Hoist and Manufacturing Company, Reading, Penn. Capital, $60,000. Incorporators, H. J. Schmick, R. D. Hoffman, both of Hamburg, Penn.; Jos. J. Johnson, Reading, Penn.

Sainer Valve Company, New York. Manufacture and deal in valves, machinery, tools, etc. Capital, $50,000. Incorporators, G. La

Francesca, G. Romano, New York; R. Hinds, Richmond Hill.

Chickamagua Steel and Iron Company, 15 Exchange place, New York City. Capital, $5,000,000. Incorporators, G. W. Adams, Montclair, N. J.; R. W. Pollock, New York City, and others.

Cleveland Motor Truck Manufacturing Company, Cleveland, Ohio. Manufacture motor trucks, do repairing, etc. Capital, $250,000. Incorporators, W. B. Stewart, G. W. Cottrell, H. E. French, etc.

Como Electrical Comany, Como, Township of Wall, Monmouth county, N. J. Manufacture electrical devices. Capital, $50,000. Incorporators, W. W. Rowan, Asbury Park, N. J., and others.

Robertson Bottle Crown Company. Capital, $100,000. Incorporators, Harry Robertson, 508 Sixth avenue, Brooklyn, N. Y.; O. J. G. Schuler, 501½ West Forty-third street, Bronx, New York City.

Whitney Gas and Electric Appliance Company, Cleveland, Ohio. Manufacture gas and electric appliances, machinery, steam-heating equipment. Capital, $10,000. Incorporators, A. Schick, F. M. Whitney, etc.

Atlas Water Tube Boiler Company, Westmont, N. J. Offices, Franklin Bank building, Philadelphia. Capital, $300,000. Incorporators, P. J. Dougherty, Philadelphia; J. B. Rettew, Philadelphia; John Quincy Adams, Westmont, N. J.

The Southern Manufacturing Company, Columbus, Miss. Capital, $75,000. Incorporators, W. W. Craig, Columbus, Miss.; Thos. F. Lundgren, Marion, O.; John F. Elder, Columbus, O. Manufacture wagons and hardware implements.

The Lafayette Manufacturing Company. Appliance for automobiles, bicycles, etc. Capital, $30,000. Incorporators, Geo. M. Shotwell, Tarrytown, N. Y.; B. A. Alperin, 349 East Seventeenth street, New York City; L. B. Gleason, Dellie, N. Y.

Business Items

The works of the Massachusetts Saw Works, Chicopee, Mass., will be closed for the annual vacation and repairs from July 30 to August 6, inclusive. The office will remain open and all inquiries and orders will be given attention.

Forthcoming Meetings

National Society for Promotion of Industrial Education, fourth annual convention, Boston, Mass., November 17, 18 and 19.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. P. Clark, secretary, 309 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Machinery or order, or will purchase good patents. Interstate Machinery Co., Troy, N. Y.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Special machinery accurately built. Screw machine or turret lathe work solicited. Robert J. Emory & Co., Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

New ideas developed, designing and detailing of special machinery; terms reasonable and work strictly confidential. Box 798, AMERICAN MACHINIST.

Light, fine machinery and mechanical specialties built to order; jigs, tools, etc., designed and built. Goodson Electric and Manufacturing Co., Providence, R. I.

A well equipped machine shop within 30 miles from New York solicits orders for all kinds of machine work. Send inquiries: The Brunswick Refrigerating Co., New Brunswick, N. J.

Light or medium weight machinery to manufacture on contract or special machinery to build. Box 734, AMERICAN MACHINIST.

A large English firm of machine-tool importers having showrooms and offices in Great Britain, France, Italy and Japan, is wanting good agencies for machine tools of all kinds. Apply Box 189, AMERICAN MACHINIST.

The lessee, a machinist, of a foundry and machine shop wants partner to join him in buying the plant; growing business and good opportunity; mechanic or capable business manager preferred. Address J. C. Koehler, Baker City, Oregon.

Concern with well equipped plant for light manufacturing wants to hear from parties with established business who are desirous of enlarging their facilities, reducing their expenses for rents, etc.; plant is well located, cheap power, fuel and labor; railroad siding. Cadiz Stamping Works, Cadiz, Ohio.

Any broken machinery parts expertly welded by oxy-acetylene process; difficult repairs requiring skilful preheating are our specialty; automobile cylinders and crank cases also; ask for detailed information, references, etc.; we positively weld (not braze) cast iron, aluminum and other metals; no charge unless successful; one trial will convince you. Waterbury Welding Works, Waterbury, Conn.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CALIFORNIA

Wanted — Bookkeeper for manufacturing plant, employing from 20 to 25 hands; young man familiar with modern uptodate methods, cost keeping, etc. Write fully age, experience, salary wanted. Box 812, AMER. MACHINIST

COLORADO

Due to the steady increase of our business, we are constantly in need of drill press, lathe, planer, grinder, Jones & Lamson and bench men; also toolmakers and tool smiths; good climate and location; steady work, good pay to first-class men; shop clean, light and well ventilated; 9 hours work. Address, stating experience. J. Geo. Leyner Engineering Works Co., Littleton, Colo.

CONNECTICUT

Wanted—We want a machine salesman to cover territory in and around New York City; standard machine that is used in all factories. Address P. O. Box 685, Waterbury, Conn.

Wanted—A first-class tool designer on automobile work ,one who has had experience in this class of work preferred; state experience and salary expected. The Columbia Motor Car Company, Hartford, Conn.

Wanted—Salesmen to handle on a generous commission basis, a well advertised and quick selling line of lathe tools; commissions given on all orders received from prescribed territory; send references with reply. Address "R. T.," AMERICAN MACHINIST.

INDIANA

Wanted—Working foreman, also inspector for assembling department on high-grade integrating wattmeters; state age, experience, and salary desired to start with. Box 803, AMERICAN MACHINIST.

Wanted—First-class all-around machine operator to do time setting for premium system for large automobile company with machine shop employing 700 men; none but first-class men need apply. Box 772, AMER. MACH.

KANSAS

Wanted—Six vertical boring-mill operators on duplicate work, and a first class drill press man on heavy work; steady employment for the right men. The Locomotive Finished Material Co., Atchison, Kas.

MARYLAND

Wanted—A first-class general foreman for safe and vault manufacture; must understand the work and know how to handle men. Box 785, AMERICAN MACHINIST.

Wanted—Foreman for paint shop by manufacturers of fireproof safes and vaults; must understand the work thoroughly and be able to handle men. Box 786, AM. MACH.

MASSACHUSETTS

Wanted — Experienced mechanical draftsman and designer for permanent position with large manufacturing concern in Massachusetts; state age, education, experience and salary expected by addressing Chief Draftsman, Box 778, AMERICAN MACHINIST.

MICHIGAN

Machinists—Men experienced at assembling the mechanism of crane bridges. Box 183, Detroit, Mich.

NEW JERSEY

Wanted—At once, a mechanical draftsman for detail work on cranes and electrical machinery; state salary and experience. Sprague Electric Co., Bloomfield, N. J.

Superintendent for machine shop wanted for large works in vicinity of New York City; must have had at least five years' experience in similar position and have handled all classes of machine work. Box 795, AM. MA.

Wanted—A competent and reliable automatic screw operator, one who has been accustomed to the Acme and Brown & Sharpe machines preferred; none but first-class men need apply; steady work and good pay. Apply at the works of Henry R. Worthington, Harrison, N. J.

NEW YORK

Wanted—First-class all-around machinist on electrical and automobile work. Box 813, AMERICAN MACHINIST.

A toolmaker of experience and ability to take charge of tool room; state full particulars and salary wanted. Box 802, AM. M.

Wanted—Quick, accurate toolmaker; state age, references and salary. Apply by letter, confidential. "S. W. F.," AMER. MACHINIST.

As superintendent of machine shop and foundry, steam pumps, etc.; up to date; practical in all departments. Box 741, AM. MA.

Patternmaker, first-class on wood patterns; good pay and steady work to competent man; give age, experience and references; vicinity of New York. Box 768, AMER. MACHINIST.

Wanted — An experienced case-hardener; one who understands the business thoroughly; good pay and steady employment; state age, experience and salary expected. Eclipse Machine Co., Elmira, N. Y.

Wanted—First-class lathe, drill press and milling machine operators for both night and day work; state past experience, wage demanded and complete information in first letter. The Kirkham Motor Mfg. Co., Bath, N. Y.

Salesmen on a generous commission basis, competent, practical tool dressers or others capable of demonstrating the merits of the most successful steel hardening solution ever sold; five years' continuous use by responsible firms vouches for its value wherever water-hardening steels are in use. Box 760, Am. M.

Assistant to sales manager; splendid opportunity for competent young man (26-30), with outside selling experience, fluent talker and A-1 correspondent; must have machinery experience and desirably a technical training; give fully experience, nationality, age, salary expected and references. "Fortunate," Box 811, AMERICAN MACHINIST.

Assistant superintendent; opportunity of life time with young growing concern manufacturing foundry equipment; prefer technical graduate (27-30), with two years' or more shop experience; to get consideration, applicants must enumerate fully experience, age, nationality, salary expected, furnish references, etc. "Exceptional," Box 810, Am. M.

OHIO

Molders wanted on light machinery in Ohio. Box 769, AMERICAN MACHINIST.

Machinists wanted on locomotive work in the Middle West. Box 770, Am. Mach.

Machinist wanted to instruct men in the use of machine tools; give age, experience. Box 771, AMERICAN MACHINIST.

Wanted—Several first-class draftsmen with experience on crane work; none others need apply; state age, experience and salary. Box 727, AMERICAN MACHINIST.

Wanted—Chief draftsman to take charge of large engineering office; must have good technical and practical training, executive ability and capable of systematizing office and getting output; good opening with opportunity for advancement; state qualifications fully in writing. Box 753, Amer. Mach.

Wanted—First-class machinists, toolmakers die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood patternmakers, brass molders, polishers, buffers, finishers, spinners, millwrights, hammermen and blacksmiths who are seeking positions or desirous of improving on those which they have, to register their names and addresses with the free Employment Department of the National Metal Trades Association. Address Commissioner's Office, 605 New England Bldg., Cleveland, O.

OKLAHOMA

Wanted—A competent job and manufacturing machine shop superintendent, who can show that he is capable and steady, of good habits; a protestant Christian preferred; must have $2000 to put in the company; shop located in Oklahoma City; good wages and a life position to right party. Box 799, AMERICAN MACHINIST.

PENNSYLVANIA

Wanted—Lathe, boring mill and floor hands; good wages, steady work. The Blaisdell Machinery Company, Bradford, Penn.

Machinists—Machine operators wanted for day and night turn; plenty of work; none but sober and steady men need apply. Standard Engineering Co., Ellwood City, Penn.

Wanted—First-class foreman for machine work; must be a man of ability in handling help and be able to show a satisfactory record as a foreman; to a man capable of filling this position satisfactorily, we will pay $100 per month. Box 777, AMERICAN MACHINIST.

Wanted—By machine tool concern, building medium size metal working machinery, an expert demonstrator to go to Europe for two years; must be first-class mechanic, capable of operating machines and assisting salesmen wherever necessary; splendid opportunity for right man. Address with full particulars, etc., Box 801, Amer. Machinist.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

WISCONSIN

Wanted—General foreman for well equipped shop, making small machines; good executive; experienced in economical production. Milwaukee. Box 754, AMERICAN MACHINIST.

A machinery salesman wanted; a fine position with large possibilities for the right man; in your reply state length of selling experience, class of machinery handled and names of references. Box 698, Am. Mach.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

ILLINOIS

Experienced, practical, systematic, superintendent in charge of a large manufacturing plant, wishes to make a change. Box 686, AMERICAN MACHINIST.

MASSACHUSETTS

Superintendent of a large manufacturing plant, with wide experience on automatic and labor saving devices, desires making a change. Box 788, AMERICAN MACHINIST.

Responsible position desired by superintendent of broad experience on designing and manufacturing medium and light machinery; expert on tool designing and experimental work. Box 773, AMERICAN MACHINIST.

As factory manager by man with good experience in factory organization, management, cost and factory systems, able to keep operating production expense at a minimum; would like to correspond with any company desiring a competent man who would study their interests entirely; can stand on own record and give best references as to ability; at present employed; can give satisfactory reason for changing. Box 814, AMERICAN MACHINIST.

MICHIGAN

Position Wanted—As superintendent or director of shop work instruction with either engineering college or trades school, by one who has had experience in this line of work. Box 819, AMERICAN MACHINIST.

MISSOURI

Superintendent or general foreman, now employed, desires change; experience in modern shop methods, manufacturing small and medium interchangeable parts; good reliable mechanic. Box 790, AMERICAN MACHINIST.

NEW JERSEY

Cornell mechanical engineering graduate, two years' drafting and office work, wishes position where faithful work is appreciated; salesmanship or office. Box 821, Am. Mach.

Automatic machine designer and draftsman with electrical and chemical knowledge, also experimental work, desires responsible position with growing firm near New York City. Box 822, AMERICAN MACHINIST.

Superintendent and factory manager, high class, hustling and efficient executive, expert on tools, dies, gages, fixtures, machine building; thoroughly understands handling help and dealing with human element in manufacturing; speed and production my specialty; never failed to exceed all expectations. Mechanical Engineer, AMERICAN MACHINIST.

NEW YORK

Draftsman, well experienced detailer, good mechanic. Box 806, AMERICAN MACHINIST.

Graduate mechanical engineer, one year's shop and six years' designing experience, desires change. Box 794, Amer. Machinist

Mechanical graduate, experienced, practical tool and die maker; familiar and up to date in die castings. Box 782, Amer. Mach.

Wanted—Position as general superintendent; have had large experience in designing and building gas engines. Box 797, Am. Ma.

Tool designer and foreman wishes change; sober and steady practical mechanic; 18 years' experience; A-1 references; go anywhere. Box 805, AMERICAN MACHINIST.

Foreman machinist, first-class executive ability, expert on repair work, contractor's plant, desires position with leading concern; references given. Box 804, Amer. Machinist.

Expert hardener, middle aged, executive ability, experienced in carbon and high-speed steel, carbonizing and case-hardening, A-1 references, wants position with full charge. Box 807, AMERICAN MACHINIST.

Draftsman, 9 years' experience, automatic machinery, including sugar, cotton, textile, labeling and special machinery, thoroughly familiar with shop methods, desires position where ability counts; good references. Box 817, AMERICAN MACHINIST.

Mechanical engineer, college graduate, German, 2½ years' experience, speaks English, wants position with good firm; chief purpose, broad experience, such as may qualify for high advancement; moderate wages; would go anywhere. Box 809, AMERICAN MACHINIST.

General foreman or superintendent, over 10 years' practical experience in typewriter and other small machinery; good technical knowledge; expert on reducing costs, systematizing and producing a better article; exceptional inventive ability; A-1 references; now in charge, wants to change; will go anywhere. Box 815, AMERICAN MACHINIST.

OHIO

Works manager; advertiser at present in charge of large plant manufacturing heavy machinery, desires change; wants position as works manager with responsible concern; wide experience handling large plants. Box 816, AMERICAN MACHINIST.

PENNSYLVANIA

Position wanted as superintendent or foreman with a reliable firm in the manufacturing of plumbing supplies, general brass and iron goods; have 18 years' experience; familiar with uptodate tools and machines; a hustler; sober and steady practical mechanic; A-1 references; city or country. Box 723, AMERICAN MACHINIST.

WISCONSIN

Superintendent, have a thorough knowledge of modern machine shop, foundry and manufacturing practice; good executive, accustomed to large works. Box 808, Amer. Machinist.

Situation wanted by mechanical and experimental engineer; experienced on special automatic machinery design and perfection; eighteen years' shop and office experience; present position superintendent. Box 779, AMERICAN MACHINIST.

FOR SALE

For Sale—In rapidly growing town in Vermont, at the junction of two railroads, six hours from Boston, a modern three-story factory building, 27,000 feet, steam heat and sprinkler system, electric lighted, one-half acre land, $5000. Box 792, Amer. Mach.

For Sale—Patent, just issued on an attachment for milling machine; good specialty for shop equipped for fine accurate work; no competition and unlimited field; price, $500; don't answer unless you mean business. G. R. Lang, Meadville, Penn.

For Sale—Full working drawings of a three cylinder 5½"x7½", four cycle, latest improved marine engine, complete with direct driven water and oil pumps and air compressor; money maker for machine shop wanting high class engine to build. Beck & Sargent, Engineers, 152 Lake St., Chicago, Ill.

For Sale—Three return tubular boilers, manufactured by Riter Bros., Buffalo, N. Y. Drums 72x16 feet 0 inches; each boiler with sixty-six 4-inch tubes; inspected by Travelers Indemnity Company, of Hartford, Conn; 93 lb. steam pressure; boilers in good condition; can be delivered in two to three months, and seen in operation at Buffalo Bolt Company's plant, North Tonawanda, N. Y.

For Sale—Large automatic gear cutters with oil pumps; one Brown & Sharpe No. 6, cuts gears up to 60 inches diameter by 12-inch face. One Gould & Eberhardt, cuts gears to 72 inches diameter by 14-inch face. One Gould & Eberhardt, cuts gears to 84 inches diameter by 16-inch face. Above machines are all practically as good as new. Address Automatic Gear Cutters, Box 818, Am. Mach.

An opportunity to start a machine shop; we offer one of our departments for sale, the one used to establish our business; it is small and profitable work, but as we are devoting ourselves to heavier work, we offer to sell for $2000, all the drawings, patterns, and stock of finished and partly finished parts and rough material (inventories over $3000), circulars, electrotypes, special machinery and fixtures, and an established trade. Address Sipp Machine Company, Paterson, N. J.

For Sale—One Nash gas engine, 20 horsepower, two cylinder, for electric lighting, pumping or power; one Beaman & Smith horizontal boring mill; table 25 inches wide, 36 inches long; will bore 12 inches diameter, 24 inches long, and face 20 inches diameter; one 300 light J. B. Colt Co. acetylene gas apparatus. The above machines are in excellent condition, having been very little used. For further particulars and prices apply to Rider Ericsson Engine Co., 35 Warren St., New York

For Sale—Machine shop, foundry, boiler, blacksmith and pattern shop and general machinery supply business; complete equipment and doing a profitable business; located in the greatest coal, metal mining and smelting, timber and farming section of Colorado; fine city, climate, water and schools; unusual opportunity for machinist and foundryman to form partnership and secure prosperous growing business, at a sacrifice; family death necessitates owner leaving. Box 800, Am. M.

Talks With Our Readers

By the Sales Manager

THERE'S nothing so interesting as facts, especially the facts of business.

There's no business more interesting, and yet so little understood, as the publishing business.

And it's the publishers' own fault.

They have been so busy doing things—bringing the publishing business to its present high standard—that they have overlooked the fact that we all sometimes enjoy getting a "peep" behind the scenes.

* * *

As far as the AMERICAN MACHINIST is concerned we are going to show you.

We're going to say things here that "editorial ethics"—whatever that is—prevents us from saying in our editorial columns.

We are going to show you the human side of publishing.

We will call your attention to ways in which we can be most helpful to you that you are not now using.

We will show you the magnitude of the business of which you are a part.

* * *

Prove to you that your interests and ours are so closely interwoven as to be identical.

That whenever you read anything in the AMERICAN MACHINIST, it's so—

As far as the best minds that we can secure can guarantee it.

* * *

That advertising is one of the most useful tools of business, for the reader as well as the advertiser.

How you can get ideas out of the advertising pages which can be used in your every-day work.

We will show why it pays to buy advertised goods—

Why they are the best and most economical.

That when an advertisement appears in the AMERICAN MACHINIST it is a guaranty to the reader.

None but the advertisements of reputable concerns appear in its columns.

Relate advertising successes and if in telling them we praise some concerns we will do it without hesitation.

And be sure of one thing—if we see a nigger's head we'll hit it.

So look for this page each week.

And read it.

In our homely way we will make it worth your while.

* * *

Say you saw it in the American Machinist.

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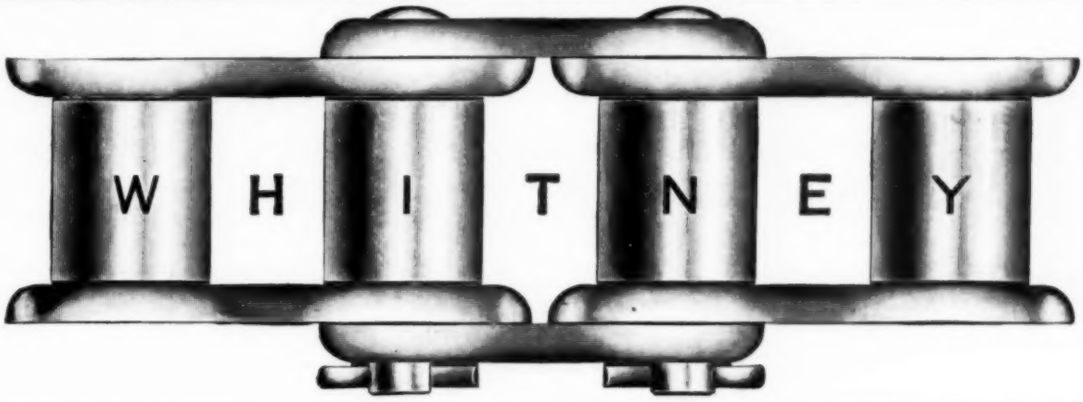

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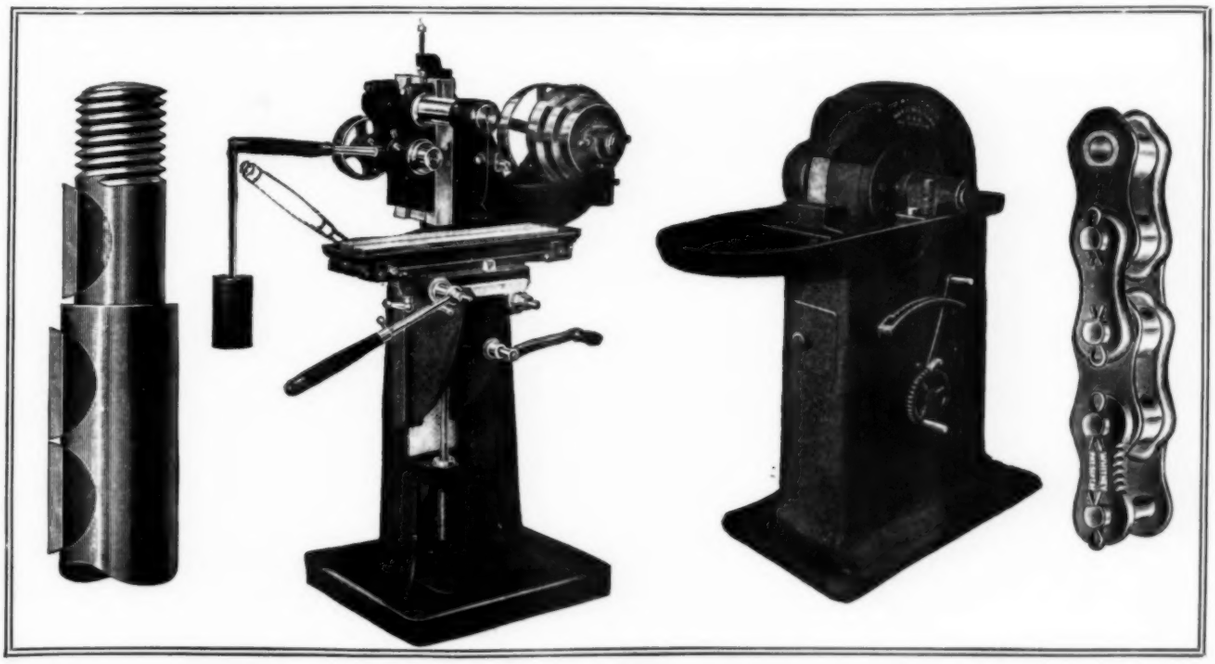

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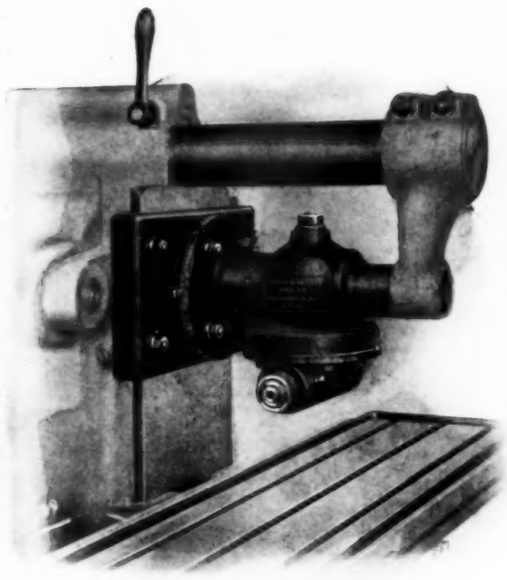
B.&S. Milling Attachments



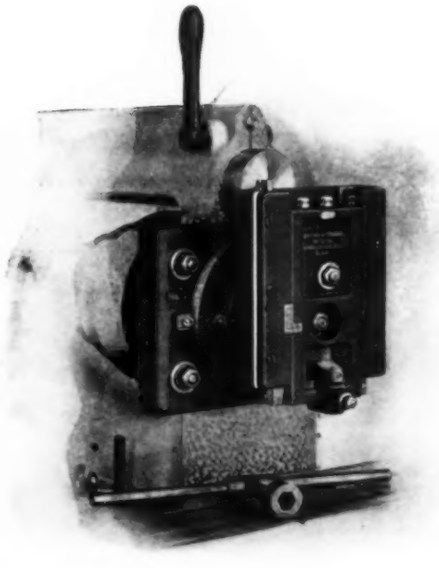
By the use of attachments it is possible to employ the milling machine on a wide range of work outside of the regular line, such as key seating, die sinking, T-slot cutting, spiral milling, slotting, rack cutting and face milling of all kinds.

The scope of the machines is greatly increased and the necessity for special machines eliminated.

Their design is of special importance

They are made to clamp rigidly to the face of the column so that they become practically integral parts of the machine. Because of this feature they are capable of transmitting the full power of the belt.

Our line of attachments includes the Universal, shown above; the Slotting, shown at the right; Vertical Spindle, light and heavy design; Rack Cutting, Compound Vertical Spindle, High Speed, Horizontal, Cam Cutting and Circular Milling Attachments.



Send for circulars of complete line or see our General Catalogue, pages 71 to 99.

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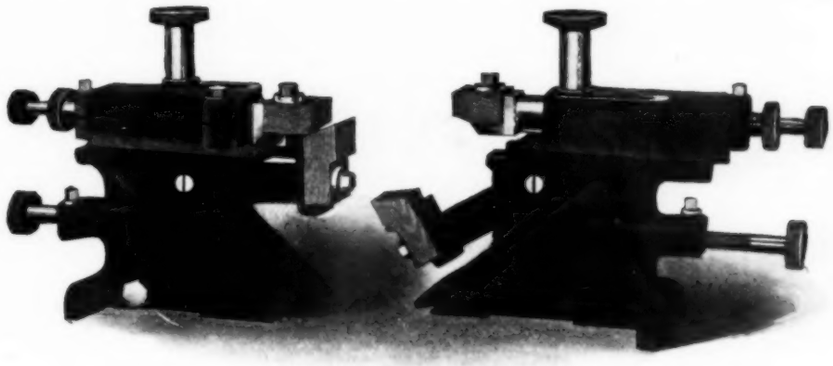
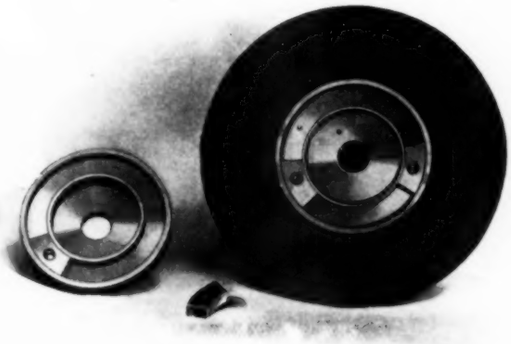
Landis Grinders Have The Biggest Reputation For Accurate Grinding



Accuracy In Grinding

Depends Largely In the Way The Work Is Supported



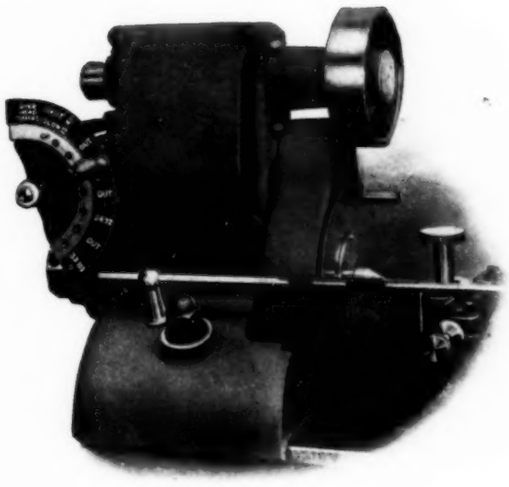
Proper support of the work is assured by the use of our improved rests, which support the work at two points, underneath and in front, each support being *adjusted independently* of the other, which is essential to perfect grinding. Another advantage of these rests is their compactness and narrowness, which is desirable when grinding between shoulders of cranks and similar work.

An Accurately Balanced Grinding Wheel

is also necessary to insure perfect grinding.

This is provided for by shifting weights in a groove in the wheel collar which are locked in position after the wheel has been balanced.

Landis Grinders have this very important feature and it is not found in any other. It is only another proof of the supremacy of the "Landis."



Powerful Headstock

The headstock is clamped against a surface along the front edge of the table which is thoroughly protected against dirt and grit, insuring alignment of centers when positions of heads are changed.

Positive clutches are used, all parts of which are made of tool steel, hardened and accurately fitted by grinding. Write at once for complete information as contained in catalog "A."

Landis Tool Company, Waynesboro, Pa.

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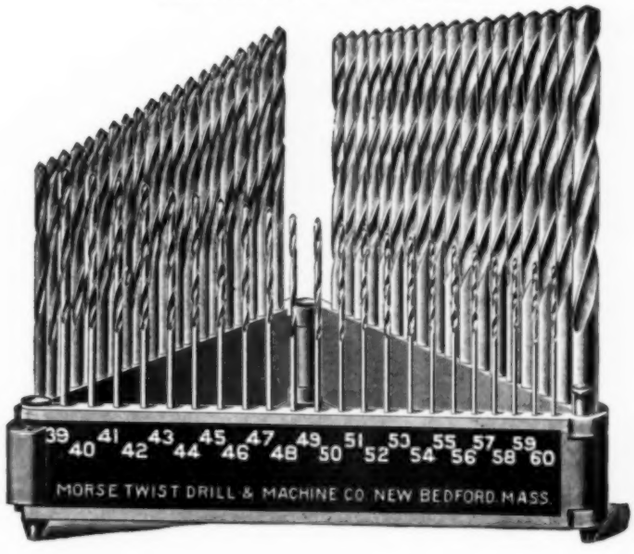

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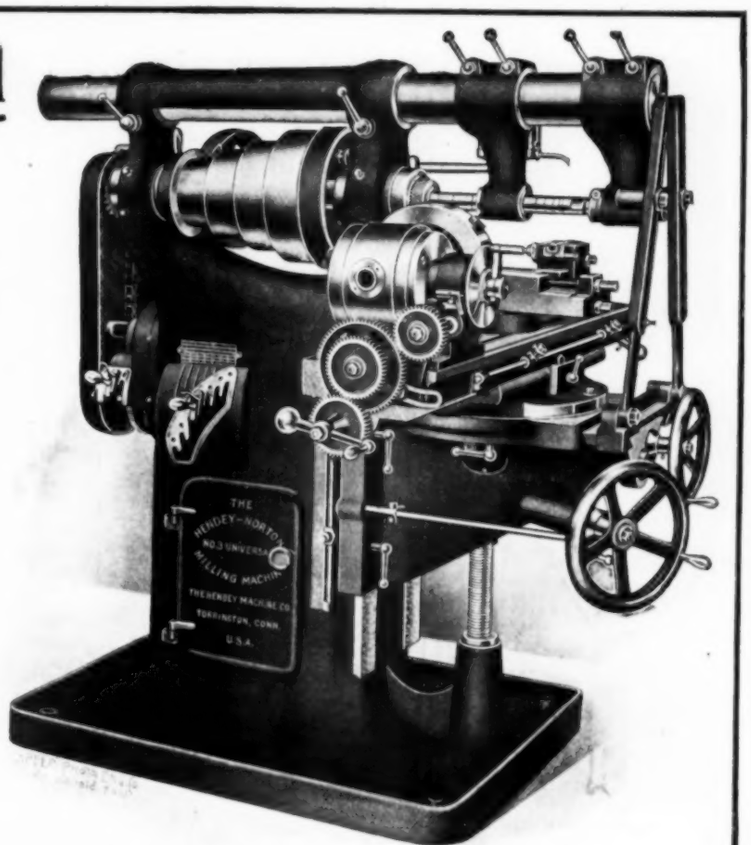

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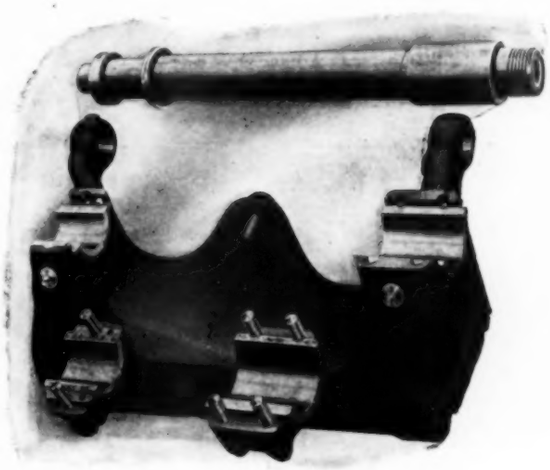

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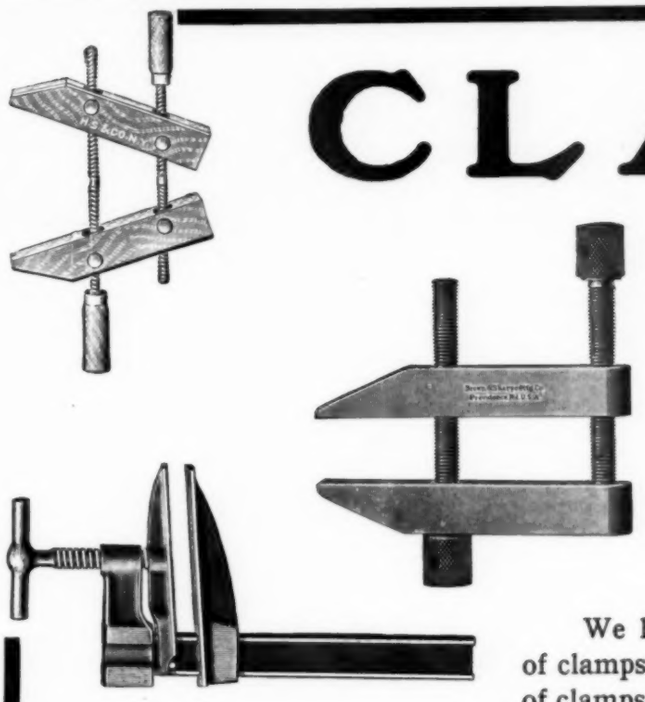

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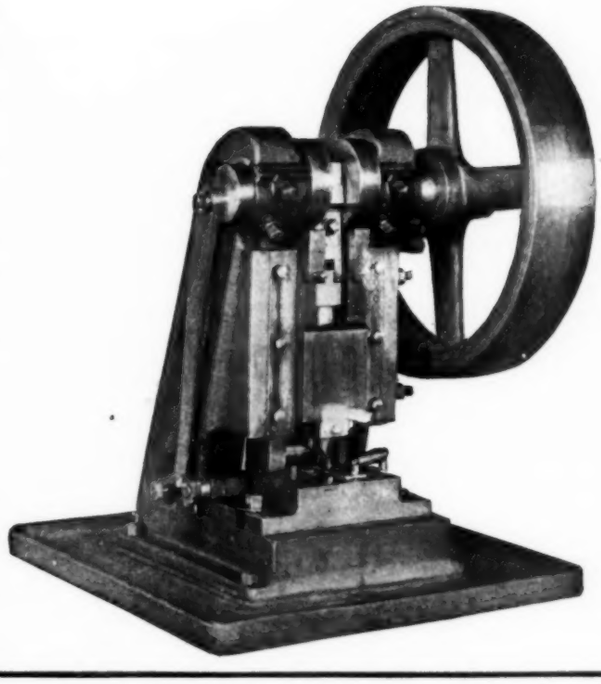

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